

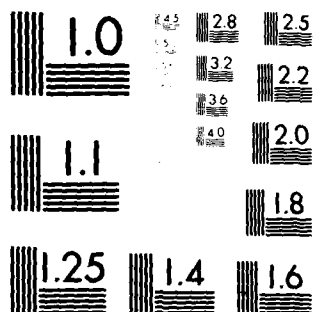
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NEW JERSEY

SKILLMAN DAM

N J 00018

PHASE 1 INSPECTION REPORT NATIONAL DAM SAFETY PROGRAM



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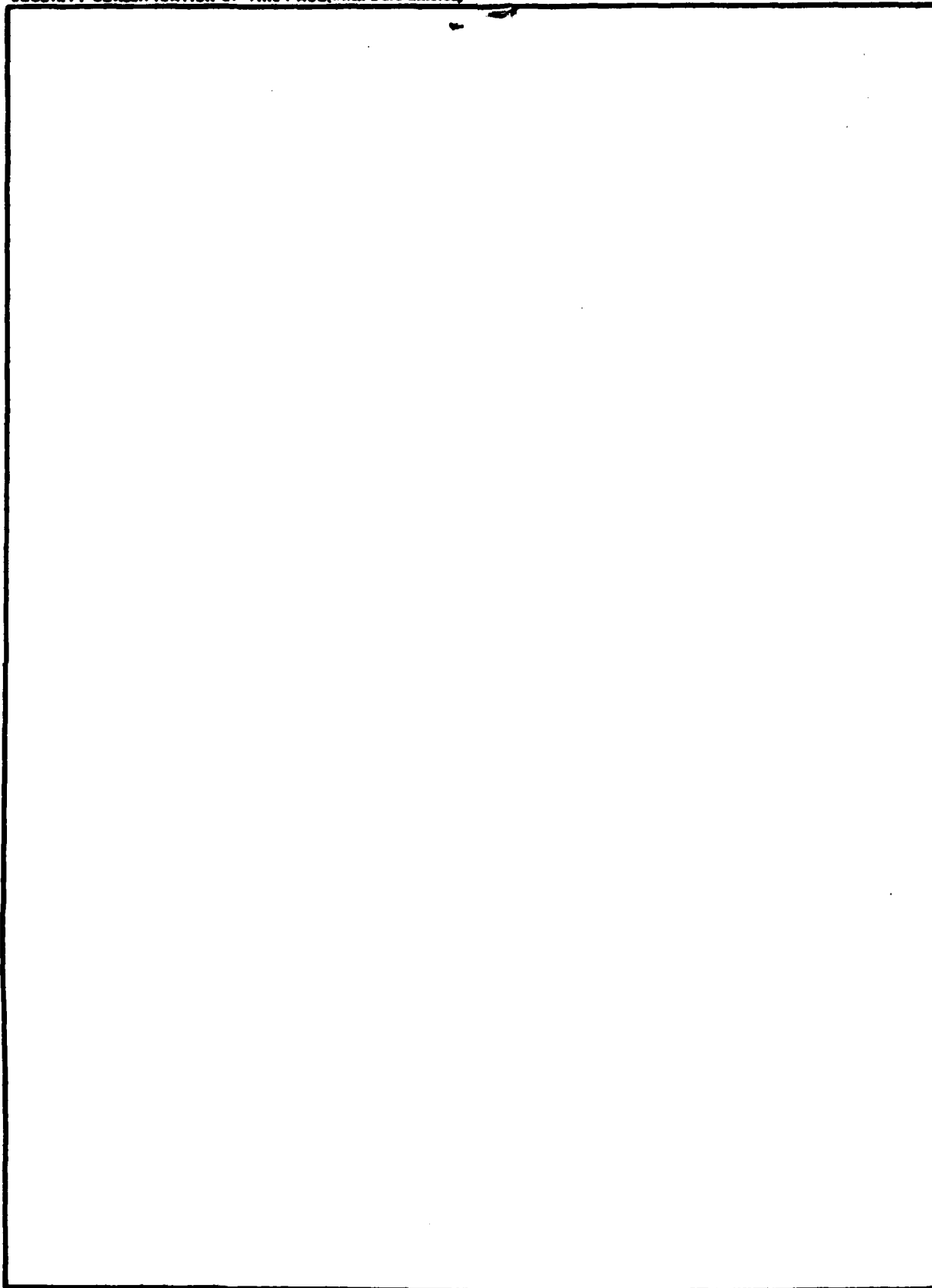
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1. REPORT NUMBER NJ00018	2. GOVT ACCESSION NO. AD-A088040	3. RECIPIENT'S CATALOG NUMBER
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20. ABSTRACT (Continue on reverse side if necessary and identify by block number) This report cites results of a technical investigation as to the dam's adequacy. The inspection and evaluation of the dam is as prescribed by the National Dam Inspection Act, Public Law 92-367. The technical investigation includes visual inspection, review of available design and construction records, and preliminary structural and hydraulic and hydrologic calculations, as applicable. An assessment of the dam's general condition is included in the report.		

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DEPARTMENT OF THE ARMY
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PHILADELPHIA, PENNSYLVANIA 19106

IN REPLY REFER TO

NAPEN-N

Honorable Brendan T. Byrne
Governor of New Jersey
Trenton, New Jersey 08621

11 AUG 1980

Dear Governor Byrne:

Inclosed is the Phase I Inspection Report for Skillman Dam in Somerset County, New Jersey which has been prepared under authorization of the Dam Inspection Act, Public Law 92-367. A brief assessment of the dam's condition is given in the front of the report.

Based on visual inspection, available records, calculations and past operational performance, Skillman Dam, a high hazard potential structure, is judged to be in fair overall condition. The dam's spillway is considered inadequate because a flow equivalent to 29 percent of the Spillway Design Flood -SDF- would cause the dam to be overtopped. (The SDF, in this instance, is one half of the Probable Maximum Flood.) The decision to consider the spillway inadequate instead of seriously inadequate is based on the determination that dam failure resulting from overtopping would not significantly increase the hazard of loss of life downstream from the dam from that which would exist just before overtopping failure. To ensure adequacy of the structure, the following actions, as a minimum, are recommended:

a. The spillway's adequacy should be determined by a qualified professional consultant engaged by the owner using more sophisticated methods, procedures, and studies within six months from the date of approval of this report. Within three months of the consultant's findings, remedial measures to ensure spillway adequacy should be initiated.

b. Within six months from the date of approval of this report, engineering studies and analyses should be performed to prepare a design for suitable slope protection for the entire embankment and the embankment should be protected according to the design.

c. The following remedial actions should be completed within six months from the date of approval of this report:

NAPEN-W

Honorable Brendan T. Byrne

(1) With the lake drawn down, the concrete spillway and north outlet structure should be thoroughly inspected by a professional engineer experienced in the design and construction of dams. Based on the inspection, any necessary remedial measures should be determined and then implemented.

(2) All trees and brush on the embankment should be removed.

(3) The owner should develop an emergency action plan together with an effective warning system outlining actions to be taken by the operator to minimize downstream effects of an emergency at the dam.

(4) The three abandoned outlets at the south end of the spillway should be further investigated to determine the need for and feasibility of restoration to functional use. The investigation should include recommendations for proper measures to restore or permanently abandon the outlets.

(5) The standing water at the embankment toe should be carefully observed in order to investigate its source and to monitor any significant change in its condition.

d. Within one year from the date of approval of this report, the owner should develop written operating procedures and a periodic maintenance plan to ensure the safety of the dam.

A copy of the report is being furnished to Mr. Dirk C. Hofman, New Jersey Department of Environmental Protection, the designated State Office contact for this program. Within five days of the date of this letter, a copy will also be sent to Congresswoman Fenwick of the Fifth District. Under the provision of the Freedom of Information Act, the inspection report will be subject to release by this office, upon request, five days after the date of this letter.

Additional copies of this report may be obtained from the National Technical Information Services (NTIS), Springfield, Virginia 22161 at a reasonable cost. Please allow four to six weeks from the date of this letter for NTIS to have copies of the report available.

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NAPEN-N

Honorable Brendan T. Byrne

An important aspect of the Dam Inspection Program will be the implementation of the recommendations made as a result of the inspection. We accordingly request that we be advised of proposed actions taken by the State to implement our recommendations.

Sincerely,

James G. Ton
JAMES G. TON
Colonel, Corps of Engineers
District Engineer

1 Incl
As stated

Copies furnished:
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Division of Water Resources
N.J. Dept. of Environmental Protection
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Trenton, NJ 08625

Mr. John O'Dowd, Acting Chief
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Trenton, NJ 08625

(6) National Dam Safety Program, Skillman
Dam (NJ00814), Furitan River Basin
Rock Brook, Somerset County, New Jersey.
Phase I Inspection Report.

10) Richard J. / M = Dermott

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SKILLMAN DAM (NJ00018)

CORPS OF ENGINEERS ASSESSMENT OF GENERAL CONDITIONS

This dam was inspected on 16 November 1979 and 11 December 1979 by Storch Engineers under contract to the State of New Jersey. The State, under agreement with the U.S. Army Engineer District, Philadelphia, had this inspection performed in accordance with the National Dam Inspection Act, Public Law 92-367.

Skillman Dam, a high hazard potential structure, is judged to be in fair overall condition. The dam's spillway is considered inadequate because a flow equivalent to 29 percent of the Spillway Design Flood -SDF- would cause the dam to be overtopped. (The SDF, in this instance, is one half of the Probable Maximum Flood.) The decision to consider the spillway inadequate instead of seriously inadequate is based on the determination that dam failure resulting from overtopping would not significantly increase the hazard of loss of life downstream from the dam from that which would exist just before overtopping failure. To ensure adequacy of the structure, the following actions, as a minimum, are recommended:

a. The spillway's adequacy should be determined by a qualified professional consultant engaged by the owner using more sophisticated methods, procedures, and studies within six months from the date of approval of this report. Within three months of the consultant's findings, remedial measures to ensure spillway adequacy should be initiated.

b. Within six months from the date of approval of this report, engineering studies and analyses should be performed to prepare a design for suitable slope protection for the entire embankment and the embankment should be protected according to the design.

c. The following remedial actions should be completed within six months from the date of approval of this report:

(1) With the lake drawn down, the concrete spillway and north outlet structure should be thoroughly inspected by a professional engineer experienced in the design and construction of dams. Based on the inspection, any necessary remedial measures should be determined and then implemented.

(2) All trees and brush on the embankment should be removed.

(3) The owner should develop an emergency action plan together with an effective warning system outlining actions to be taken by the operator to minimize downstream effects of an emergency at the dam.

(4) The three abandoned outlets at the south end of the spillway should be further investigated to determine the need for and feasibility of restoration to functional use. The investigation should include recommendations for proper measures to restore or permanently abandon the outlets.

(5) The standing water at the embankment toe should be carefully observed in order to investigate its source and to monitor any significant change in its condition.

d. Within one year from the date of approval of this report, the owner should develop written operating procedures and a periodic maintenance plan to ensure the safety of the dam.

APPROVED:

James G. Ton
JAMES G. TON

Colonel, Corps of Engineers
District Engineer

DATE:

July 15 1980

PHASE I REPORT
NATIONAL DAM SAFETY PROGRAM

Name of Dam:	Skillman Dam, NJ00018
State Located:	New Jersey
County Located:	Somerset
Drainage Basin:	Raritan River
Stream:	Rock Brook
Dates of Inspection:	November 16, 1979 December 11, 1979

Assessment of General Condition of Dam

Based on visual inspection, past operational performance and Phase I engineering analyses, Skillman Dam is assessed as being in fair overall condition.

Hydraulic and hydrologic analysis indicate that the spillway is inadequate. The discharge capacity of the spillway is not sufficient to pass the designated spillway design flood (SDF) without an overtopping of the dam. (The SDF for Skillman Dam is equal to one-half the probable maximum flood.) The spillway is capable of passing approximately 14 percent of the probable maximum flood, or 28 percent of the SDF. Therefore, the owner should, in the near future, engage a professional engineer experienced in the design and construction of dams to perform more accurate hydraulic and hydrologic analyses relating to spillway capacity. Based on the findings of the analyses, the need for and type of remedial measures should be determined and then implemented.

The owner should, in the near future, develop an emergency action plan together with an effective warning system outlining actions to be taken by the operator to minimize downstream effects of an emergency at the dam.

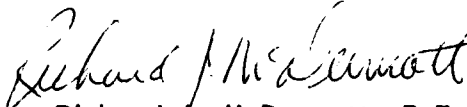
Erosion was observed on the upstream and downstream faces of the embankment. It is therefore recommended that a professional engineer experienced in the design and construction of dams be engaged in the near future to prepare a design for suitable slope protection for the entire embankment and the embankment should be protected according to the design.

In addition, it is recommended that the following remedial measures be undertaken by the owner in the near future.

- 1) With the lake drawn down the concrete spillway and north outlet structure should be thoroughly inspected by a professional engineer experienced in the design and construction of dams. Based on the inspection, any necessary remedial measures should be determined and then implemented.
- 2) All trees and brush on the embankment should be removed.
- 3) The standing water at the embankment toe should be monitored on a periodic basis by a professional engineer experienced in the design and construction of dams in order to detect any changes in its condition.

In the near future, the owner of the dam should develop written operating procedures and a periodic maintenance plan to insure the safety of the dam.

The three abandoned outlets at the south end of the spillway should be further investigated in the near future to determine the need for and feasibility of restoration to functional use. The investigation should include recommendations for proper measures to restore or permanently abandon the outlets.


Richard J. McDermott, P.E.


John E. Gribbin, P.E.



OVERVIEW - SKILLMAN DAM

29 NOVEMBER 1979

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PREFACE

This report is prepared under guidance contained in the Recommended Guidelines for Safety Inspection of Dams, for Phase I Investigations. Copies of these guidelines may be obtained from the Office of Chief of Engineers, Washington, D.C. 30214. The purpose of a Phase I Investigation is to identify expeditiously those dams which may pose hazards to human life or property. The assessment of the general condition of the dam is based upon available data and visual inspections. Detailed investigation, and analyses involving topographic mapping, subsurface investigations, testing, and detailed computational evaluations are beyond the scope of a Phase I investigation; however, the investigation is intended to identify any need for such studies.

In reviewing this report, it should be realized that the reported condition of the dam is based on observations of field conditions at the time of inspection along with data available to the inspection team. It is important to note that the condition of dam depends on numerous and constantly changing internal and external conditions, and is evolutionary in nature. It would be incorrect to assume that the present condition of the dam will continue to represent the condition of the dam at some point in the future. Only through continued care and inspection can there be any chance that the unsafe conditions be detected.

Phase I inspections are not intended to provide detailed hydrologic and hydraulic analyses. In accordance with the established Guidelines, the Spillway Test flood is based on the estimated "Probable Maximum Flood" for the region (greatest reasonably possible storm runoff), or fractions thereof. The test flood provides a measure of relative spillway capacity and serves as an aid in determining the need for more detailed hydrologic and hydraulic studies, considering the size of the dam, its general condition and the downstream damage potential.

PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM

SKILLMAN DAM, I.D. NJ00018

SECTION 1: PROJECT INFORMATION

1.1 General

a. Authority

Public Law 92-367, August 8, 1972 authorized the Secretary of the Army, through the Corps of Engineers, to initiate a National Program of Dam Inspection throughout the United States. The Division of Water Resources of the New Jersey Department of Environmental Protection (NJDEP) in cooperation with the Philadelphia District of the Corps of Engineers has been assigned the responsibility of supervising the inspection of dams within the State of New Jersey. Storch Engineers has been retained by the NJDEP to inspect and report on a selected group of these dams. The NJDEP is under agreement with the Philadelphia District of the Corps of Engineers.

b. Purpose of Inspection

The visual inspections of Skillman Dam were made on November 16, 1979 and December 11, 1979. The purpose of the inspections was to make a general assessment of the structural integrity and operational adequacy of the dam structure and its appurtenances.

1.2 Description of Project

a. Description of Dam and Appurtenances

Skillman Dam is an earth dam with a concrete free overflow spillway section and reportedly containing a concrete corewall. The spillway, which is located at the left, or north, end of the embankment, is constructed with vertical concrete walls at each end. The south wall contains three 24-inch outlet pipes (now abandoned) and abuts the earth embankment. The north wall contains a 20-inch outlet pipe and a 10-inch water supply pipe and forms the north abutment of the dam.

The spillway contains four concrete piers formed into its crest. The piers formerly supported a timber walkway which is now completely removed.

The three abandoned outlets in the south wall adjacent to the spillway are each equipped with an operating stem mounted in a steel frame secured to the upstream face of the wall. The downstream side of the wall is partially obscured by earth fill. The outlet gate in the north wall is operated by a steel mechanism mounted on top of the wall. A steel grate is fitted on the upstream side of the outlet.

The embankment has a top width of approximately 8 feet and upstream and downstream slopes of 1.6 horizontal to 1 vertical and 5 horizontal to 1 vertical, respectively. The elevation of the crest of dam is 98.5 national geodetic vertical datum (N.G.V.D.) while that of the spillway crest is 93.0. The overall length of the dam, including concrete spillway section, is 272 feet. The length of the spillway weir, not including pier widths, is 67.5 feet. The height of the dam is 16.3 feet.

b. Location

Skillman Dam is located on the property of the New Jersey Neuropsychiatric Institute at Skillman in Montgomery Township, Somerset County, New Jersey. The dam is constructed across Rock Brook, a tributary of Millstone River in the Raritan River Basin and impounds Sylvan Lake. Principal access to the dam is by internal roads in the Institute complex.

c. Size and Hazard Classification

Size and Hazard Classification criteria presented in "Recommended Guidelines for Safety Inspection of Dams," published by the U.S. Army Corps of Engineers are as follows:

SIZE CLASSIFICATION

	<u>Impoundment</u>	
	<u>Storage (Ac-ft)</u>	<u>Height (Ft.)</u>
Small	< 1000 and ≥ 50	< 40 and ≥ 25
Intermediate	≥ 1000 and $< 50,000$	≥ 40 and < 100
Large	$\geq 50,000$	≥ 100

HAZARD POTENTIAL CLASSIFICATION

<u>Category</u>	<u>Loss of Life</u> (Extent of Development)	<u>Economic Loss</u> (Extent of Development)
Low	None expected (no permanent structures for human habitation)	Minimal (Undeveloped to occasional structures or agriculture)
Significant	Few (No urban developments and no more than a small number of inhabitable structures)	Appreciable (Notable agriculture, industry or structures)
High	More than a small number	Excessive (Extensive community, industry or agriculture)

The following data relating to size and downstream hazard for Skillman Dam had been obtained for this Phase I assessment:

Storage: 133 Acre-feet

Height: 16.3 feet

Potential Loss of Life:

Two dwellings are located approximately 3200 feet downstream from the dam in an area that reportedly becomes severely flooded during heavy rainstorms. Failure of the dam due to overtopping could cause inundation of these dwellings and loss of life.

Potential Economic Loss:

The following facilities, located within 1 mile of the dam, could be damaged as a result of a breach: exposed steam pipes, a road bridge, buildings associated with maintenance and power supply for the Institute, two dwellings and a sewage treatment plant.

Therefore, Skillman Dam is classified as "small" size and "high" hazard potential.

d. Ownership

Skillman Dam is owned and maintained by the New Jersey Neuropsychiatric Institute.

e. Purpose of Dam

Reportedly, until 1968 the purpose of the dam was for the impoundment of a lake used for water supply. Since then the lake has been used for flood control, recreation and fire protection.

f. Design and Construction History

The dam reportedly was originally constructed in or about 1930. Reportedly, in 1943, three gated 24-inch outlet pipes were installed adjacent to the south end of the spillway. In 1961, the timber walkway over the spillway was washed out. The earth embankment was washed out during hurricane "Doria" and subsequently repaired; at which time fill was placed on the downstream side of the wall containing the three abandoned 24-inch outlets. In 1972, the north abutment of the dam was repaired with concrete.

g. Normal Operational Procedures

The dam and appurtenances are maintained by the maintenance staff at the Institute. There is no fixed schedule of maintenance, repairs are made as the need arises. Reportedly, the lake was last lowered around 1972 to facilitate repairs to the dam.

1.3 Pertinent Data

a.	Drainage Area	7.7 Sq. Miles
b.	Drainage at Damsite	
	Maximum flood at dam site	Unknown
	Outlet works at normal pool elevation	26 c.f.s.
	Spillway capacity at top of dam (Elev. 98.5)	2,662.c.f.s.
c.	Elevation (N.G.V.D.)	
	Top of dam	98.5
	Maximum pool-design surcharge	102.1
	Normal pool	93.1
	Spillway crest	93.0
d.	Reservoir	
	Length of maximum pool	4650 feet (Estimated)
	Length of normal pool	3750 feet (scaled)
e.	Storage (Acre-feet)	
	Spillway crest	25 Acre-feet
	Design surcharge	287 Acre-feet
	Top of dam (Elev. 98.5)	133 Acre-feet
f.	Reservoir Surface (Acres)	
	Spillway crest	9.2 Acres
	Top of dam (Elev. 98.5)	34.4 Acres
	Maximum pool - design surcharge	63.5 Acres

g. Dam

Type	Earthfill
Length	272 feet
Height	16.3 feet
Top Width	8 feet
Side Slopes	
Embankment - Upstream	1.6 horiz. to 1 vert.
- Downstream	5 horiz. to 1 vert.
Zoning	Unknown
Impervious core	Concrete corewall
Cutoff	Unknown
Grout Curtain	Unknown

h. Diversion and Regulating Tunnel N.A.

i. Spillway

Type	Uncontrolled concrete weir
Length of weir	67.5 feet
Crest elevation	93.0
Gates	N.A.
Upstream channel	N.A.
Downstream channel	Natural stream

j. Regulating Outlets

20" CIP with gate at upstream end, at north end of dam.
Three gates at south end of spillway - not operable.

SECTION 2: ENGINEERING DATA

2.1 Design

No calculations, reports or plans pertaining to the design of the dam are available.

2.2 Construction

No data or reports pertaining to the construction of the dam are available. However, construction drawings for the 1972 repairs to the north abutment are available from Storch Engineers.

2.3 Operation

Reports of inspections made by Storch Engineers and the State of New Jersey in 1971 are available. The Storch Engineers' report identified the areas of downstream hazard potential and made the following recommendations for remedial measures: 1) place riprap on the embankment, 2) repair the north abutment of the dam and 3) perform a hydraulic study which would lead to implementation of measures to withstand the forces exerted by a storm of the intensity and duration of that of August 1971.

The State of New Jersey report traced the construction history of the dam and also made the following recommendations: 1) strengthen the north abutment, 2) reinforce the eroded toe of embankment and 3) establish an early warning system in case of impending storms.

Of all the recommendations made in the two reports, only the repairs to the north abutment are known to have been implemented.

2.4 Evaluation

a. Availability

Available engineering information is limited to that on file at the New Jersey Neuropsychiatric Institute Maintenance Department and at Storch Engineers.

b. Adequacy

Available engineering data pertaining to Skillman Dam is of limited assistance in the performance of a Phase I evaluation. A list of absent information is included in paragraph 7.1.b.

c. Validity

Most information that could be verified was found to be valid within a reasonable allowance for error.

SECTION 3: VISUAL INSPECTION

3.1 Findings

a. General

The inspections of Skillman Dam took place on November 16 and December 11, 1979 by members of the staff of Storch Engineers. A copy of the visual inspection check list is contained in Appendix 1. The following procedures were employed for the inspection:

- 1) The embankments of the dam, appurtenant structures and adjacent areas were examined.
- 2) The embankment and appurtenant structures were measured and key elevations determined with the use of a surveyor's level.
- 3) The embankment, appurtenant structures and adjacent areas were photographed.
- 4) Depths of water were measured at various locations in the lake.

b. Spillway and Outlet Works

Generally, the spillway and adjacent concrete walls appeared to be outwardly stable. Although the upstream and downstream faces could not be clearly observed, evidence of longitudinal cracks on the downstream face were noted. The concrete forming the north abutment appeared to be in good condition. The training walls appeared to be generally sound with some cracks and spalls observed.

The piers located along the spillway crest appeared to be generally stable with concrete surfaces in satisfactory condition.

Four outlet control stems were observed. Three were located at the southern concrete abutment and one at the northern abutment. The north outlet is reported to be the only one operable. A significant amount of rust was observed on the frames and stems of the south outlet controls.

c. Embankment

The embankment was extremely overgrown with trees, bushes and briers. The briers on the crest were observed to be bent in the downstream direction. The embankment was eroded on the upstream and downstream faces, especially in the area downstream of the concrete wall containing the abandoned south outlets. The concrete corewall was not observed.

Standing water was observed immediately downstream from the toe along the right or south portion of the dam. The origin of the water could not be determined at the time of inspection. The water could be due to seepage or ground water emerging from higher land south of the dam.

d. Reservoir Area

The impoundment (Sylvan Lake) is bordered by woods on the south shore and by a grassed bank and paved road along its north shore. Two frame buildings are located along the north bank: a former ice house used for storage and a boat house in which a rowboat equipped with life saving equipment is stored.

e. Downstream Channel.

The spillway discharges directly into Rock Brook which is a generally well defined stream with a bottom of cobbles, boulders and soil. The banks are wooded and generally steep with an average grade of approximately 5 horizontal to 1 vertical.

Several structures are located along the channel within one mile of the dam. These include exposed steam pipes, buildings associated with maintenance and power supply for the Institute, a road bridge and two dwellings 3200 feet downstream and a sewage treatment plant one mile downstream.

SECTION 4: OPERATIONAL PROCEDURES

4.1 Procedures

The level of water in Sylvan Lake is regulated naturally by discharge over the concrete spillway of Skillman Dam. Reportedly, the outlet works is not used during times of intense storms to augment the spillway capacity.

Reportedly, the outlet gate is opened to lower the lake to facilitate maintenance operations. The most recent drawdown was performed in 1972 when the north abutment was repaired. According to the State of New Jersey inspection report, the lake can be lowered at a rate of 3 feet per day.

4.2 Maintenance of the Dam

Reportedly, there is no program of regular maintenance of the dam and appurtenant structures. Maintenance is performed on an "as needed" basis by Skillman Institute personnel.

The most recent maintenance reportedly was repair of the north abutment in 1972 and the repair of the washed out embankment in or around 1971. The latter repair involved the refilling of the embankment, including the area on the downstream side of the three abandoned outlets, without the use of formal plans and specifications.

4.3 Description of Warning System

Reportedly, no formal warning system is in use at the present time.

4.4 Evaluation of Operational Adequacy

Maintenance documentation is poor and the maintenance program for the dam appears to be insufficient in the following areas:

- 1) Embankment overgrown with trees, bushes and briers.
- 2) Walkway spanning the spillway not replaced.
- 3) Erosion on the embankment not repaired.

SECTION 5: HYDRAULIC/HYDROLOGIC

5.1 Evaluation of Features

a. Design Data

The quantity of storm water runoff that the spillway should be able to pass without an overtopping of the dam is based on the size and hazard classification of the dam. This runoff, called the Spillway Design Flood (SDF), is described in terms of frequency or probable maximum flood (PMF) depending on the extent of the dam's size and potential hazard. According to the "Recommended Guidelines for Safety Inspection of Dams," published by the U.S. Army Corps of Engineers, the SDF for Skillman Dam falls in a range of 1/2 PMF to PMF. In this case the low end of the range, 1/2 PMF, is chosen since the factors used to select size and hazard classification are on the low side of their respective ranges.

The SDF hydrograph for Skillman Dam was computed by use of the HEC-1-DB computer program using the SCS triangular hydrograph with curvilinear transformation. Hydrologic computations and computer output are contained in Appendix 4. The calculated SDF peak inflow for Skillman Dam is 9401 c.f.s.

Discharge capacity for the spillway was computed by considering free discharge over the spillway. Hydraulic computations are contained in Appendix 4.

A routing of the SDF through Skillman Dam resulted in an overtopping of the dam by a depth of 3.6 feet. A breach analysis indicated that dam failure resulting from overtopping would not significantly increase the hazard to loss of life downstream over that which would exist without failure.

Accordingly, the subject spillway is assessed as being inadequate in accordance with criteria developed by the U.S. Army Corps of Engineers.

b. Experience Data

In 1971, it was reported that 100 feet of the earth embankment was overtopped and eroded to expose the core wall. One homeowner downstream reported flood damage and a portion of the Institute property was inundated. A major crack to the core wall was also observed by the maintenance department of the Institute. Immediate repair was reportedly done by the maintenance department which included backfilling the embankment.

Reportedly, the downstream area in the vicinity of the road bridge 3200 feet from the dam becomes severely flooded during periods of intense storms.

c. Visual Observations

Briers on the crest of the embankment were observed to be bent in the downstream direction. This could possibly be due to overtopping of the dam. Also, erosion of the embankment was observed indicating the former presence of high water.

d. Overtopping Potential

As indicated in paragraph 5.1.a., a storm of magnitude equivalent to the SDF would cause overtopping of the dam by a height of 3.6 feet over the top of dam. The spillway is capable of passing approximately 28% of the SDF with lake level equal to the top of the dam (elev. 98.5).

e. Drawdown Data

Drawdown of Sylvan Lake is accomplished by opening the 20-inch gate at the north end of the dam. Total time for drawdown is estimated to be 2.5 days. (See Appendix 4.)

SECTION 6: STRUCTURAL STABILITY

6.1 Evaluation of Structural Stability

a. Visual Observations

The dam appeared, at the time of inspection, to be outwardly structurally stable. Evidence of longitudinal cracks were observed on the downstream face of the spillway. Erosion was observed on the embankment and possible seepage was observed immediately downstream from the embankment.

b. Generalized Soils Description

The generalized soils description of the dam site consists of recent alluvium composed of stratified materials deposited by streams. The alluvium overlies thin beds of soft shale, colored dull red, with occasional interstratified beds of fine grained sandstone, all dipping gently toward the northwest. The shale bedrock breaks easily into small fragments 1/4" to 1-1/2" in size and is identified as Brunswick shale.

c. Design and Construction Data

Structural stability analyses for the dam are not available.

d. Operating Records

Reports of inspections made by the State of New Jersey and by Storch Engineers are available. According to the reports, the spillway showed no signs of distress, although the northerly

abutment was endangered because its footing had partially deteriorated and the supporting rock had eroded allowing leakage through cracks in the shale. This condition was corrected by reinforcing with concrete.

Maintenance personnel reported observing a crack in the concrete core wall at the time the embankment was repaired following the washout of 1971.

e. Post Construction Changes

Reportedly, in 1943 a sluiceway containing three gated 24-inch outlet pipes was installed adjacent to the south end of the spillway. In 1971, fill was placed on the downstream side of the sluiceway. In 1972, the north abutment was repaired by reinforcing with concrete.

f. Seismic Stability

Skillman Dam is located in Seismic Zone 1 as defined in "Recommended Guidelines for Safety Inspection of Dams," which is a zone of very low seismic activity. Experience indicates that dams in Seismic Zone 1 will have adequate stability under seismic loading conditions if stable under static loading conditions. Skillman Dam appeared to be stable under static loading conditions at the time of inspection.

SECTION 7: ASSESSMENT AND RECOMMENDATIONS

7.1 Dam Assessment

a. Safety

Based on hydraulic and hydrologic analyses outlined in Section 5 and Appendix 4, the spillway of Skillman Dam is assessed as being inadequate.

The dam appeared, at the time of inspection, to be generally outwardly stable. Possible seepage and longitudinal cracks in the spillway were observed and a crack in the concrete core wall has been previously reported.

b. Adequacy of Information

Information sources for this study include: 1) field inspection, 2) USGS quadrangle, 3) aerial photography, 4) consultation with representatives of Skillman Institute and 5) plans and inspection reports from the files of Storch Engineers and Skillman Institute. The information outlined is sufficient to allow a Phase I assessment as outlined in "Recommended Guidelines for Safety Inspection of Dams."

Some of the absent data are as follows:

1. Soils Report
2. Complete plans of the dam
3. Structural Design Report
4. Hydraulic Design Report
5. Maintenance Documentation

c. Necessity for Additional Data/Evaluation

Although some data pertaining to Skillman Dam are not available, additional data are not considered imperative for this Phase I evaluation.

7.2 Recommendations

a. Remedial Measures

Based on hydraulic and hydrologic analyses outlined in paragraph 5.1.a., the spillway is assessed as being inadequate. It is therefore recommended that a professional engineer experienced in the design and construction of dams be engaged in the near future to perform more accurate hydraulic and hydrologic analyses relating to spillway capacity. Based on the findings of these analyses, the need for and type of remedial measures should be determined and then implemented.

The owner should, in the near future develop an emergency action plan together with an effective warning system outlining actions to be taken by the operator to minimize downstream effects of an emergency at the dam.

Erosion was observed on the upstream and downstream faces of the embankment, it is therefore recommended that a professional engineer experienced in the design and construction of dams be engaged in the near future to prepare a design for suitable slope protection for the entire embankment and the embankment should be protected according to the design.

In addition, it is recommended that the following remedial measures be undertaken by the owner in the near future.

- 1) With the lake drawn down, the concrete spillway and north outlet structure should be thoroughly inspected by a professional engineer experienced in the design and construction of dams. Based on the inspection, any necessary remedial measures should be determined and then implemented.
- 2) All trees and brush on the embankment should be removed.
- 3) The standing water at the embankment toe should be monitored on a periodic basis by a professional engineer experienced in the design and construction of dams in order to detect any changes in its condition.

b. Maintenance

In the near future, the owner of the dam should develop written operating procedures and a periodic maintenance plan to insure the safety of the dam.

c. Additional Studies

The three abandoned outlets at the south end of the spillway should be further investigated in the near future to determine the need for and feasibility of restoration to functional use. The investigation should include recommendations for proper measures to restore or permanently abandon the outlets.

PLATES

SKILLMAN DAM

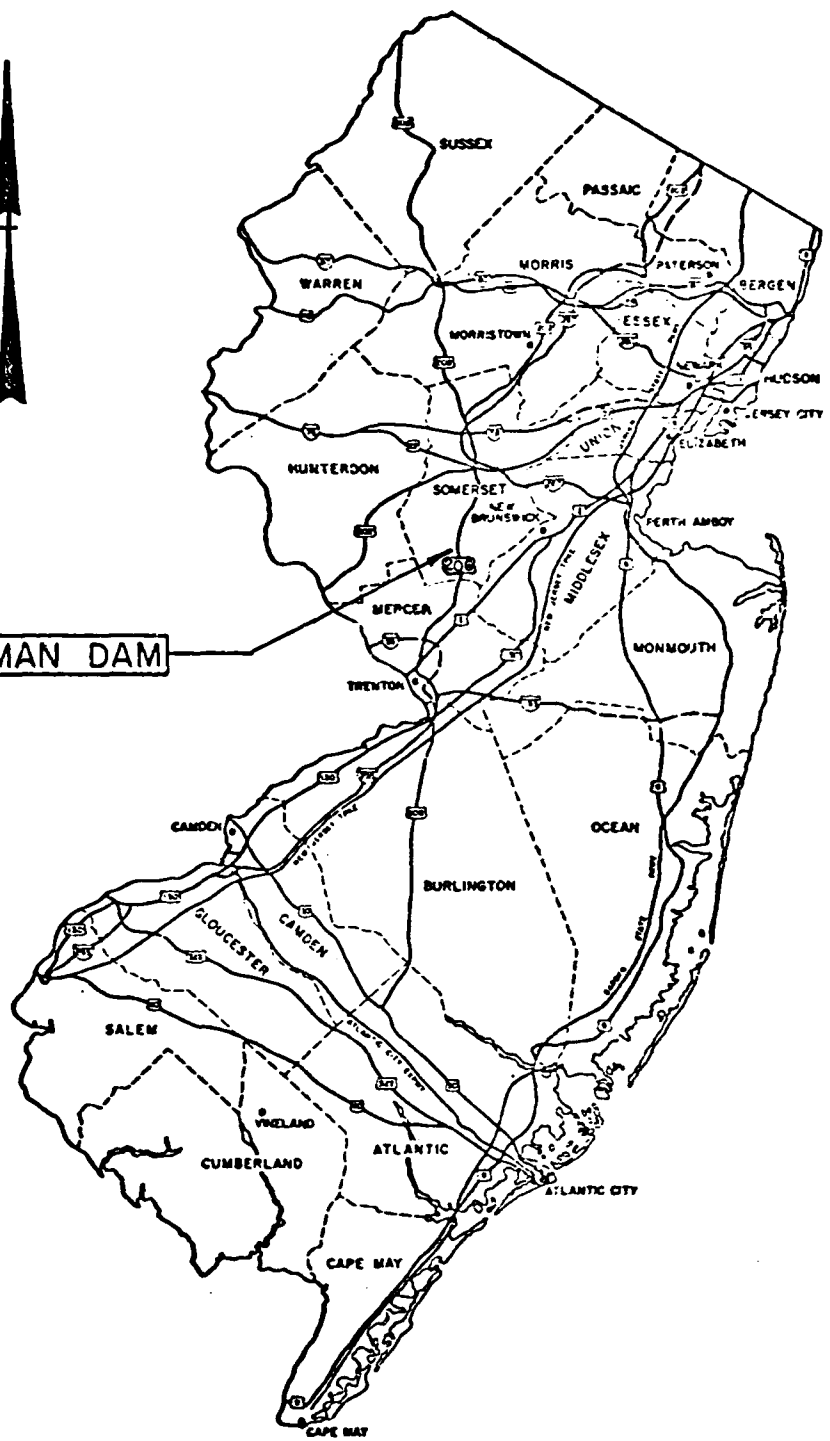
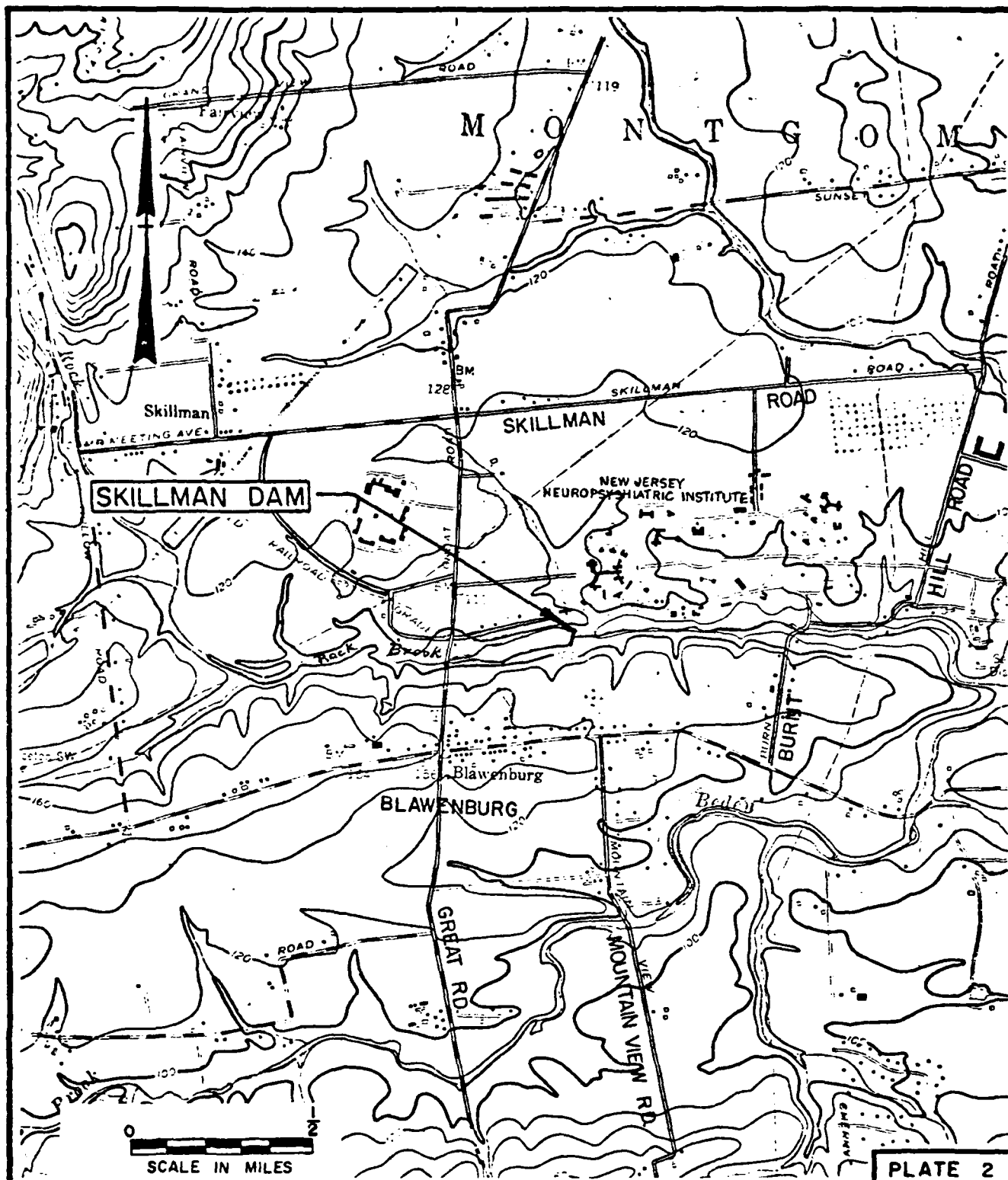


PLATE 1

<p>STORCH ENGINEERS FLORHAM PARK, NEW JERSEY</p>	<p>INSPECTION AND EVALUATION OF DAMS KEY MAP SKILLMAN DAM</p>	
<p>DIVISION OF WATER RESOURCES N.J. DEPT. OF ENVIR. PROTECTION TRENTON, NEW JERSEY</p>	<p>I.D. N.J. 00018</p>	<p>SCALE: NONE DATE: NOV., 1979</p>



STORCH ENGINEERS
FLORHAM PARK, NEW JERSEY

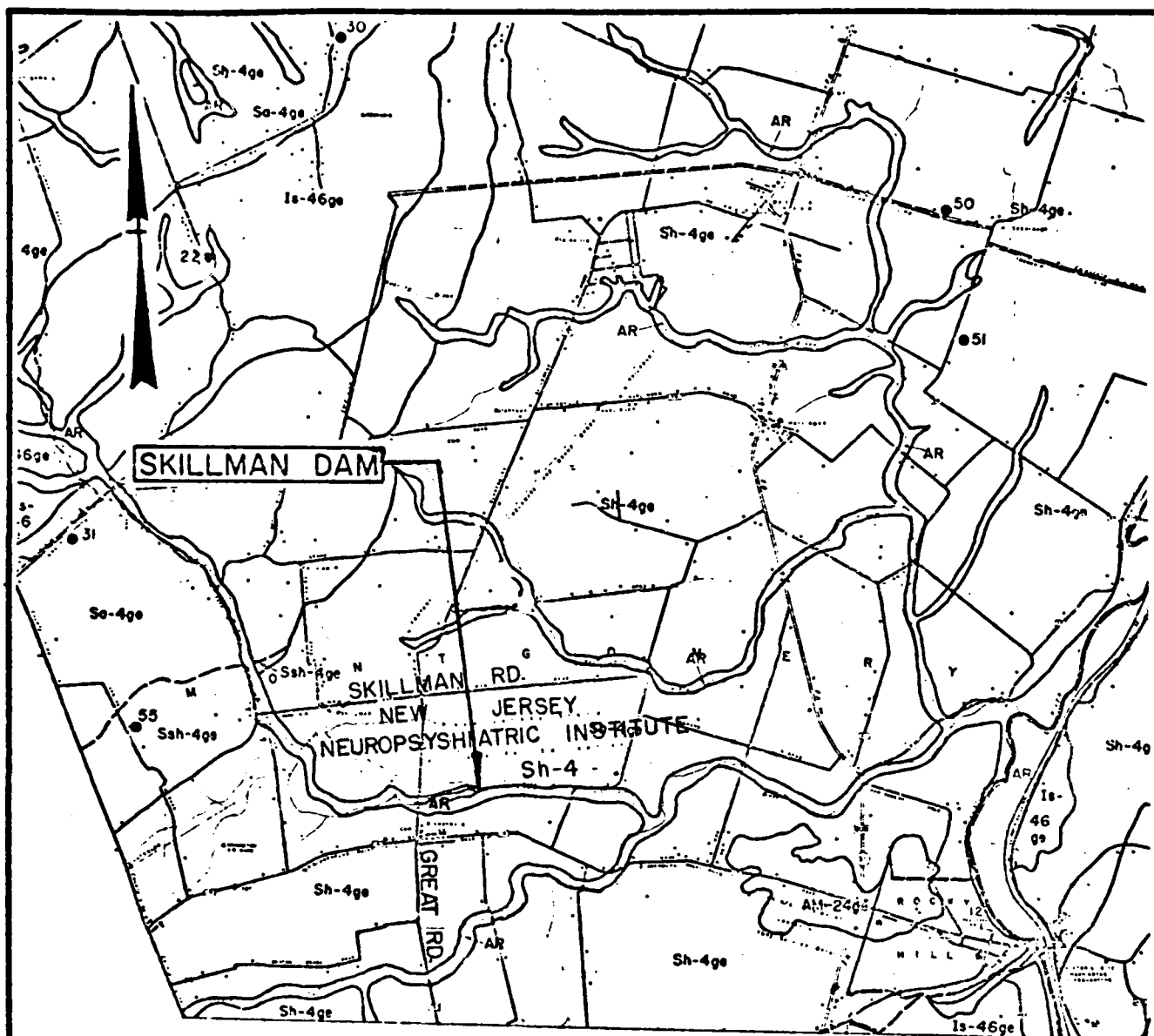
DIVISION OF WATER RESOURCES
N.J. DEPT. OF ENVIR. PROTECTION
TRENTON, NEW JERSEY

INSPECTION AND EVALUATION OF DAMS VICINITY MAP SKILLMAN DAM

I.D. N.J. 00018

SCALE: AS SHOWN

DATE: NOV., 1979



Legend

AR Recent alluvium composed of stratified materials deposited by streams.

Sh-4 Silts with silty clays in the depressions overlying thin beds of soft shale colored dull red.

Note: Information taken from Rutgers University Soil Survey of New Jersey, Report No. 7, Somerset County, and Geologic Map of New Jersey prepared by Lewis and Kummel.

PLATE 3

STORCH ENGINEERS
FLORHAM PARK, NEW JERSEY

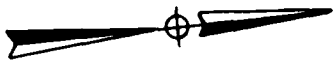
DIVISION OF WATER RESOURCES
N.J. DEPT. OF ENVIR. PROTECTION
TRENTON, NEW JERSEY

INSPECTION AND EVALUATION OF DAMS SOIL MAP SKILLMAN DAM

I.D. N J 00018

SCALE: NONE

DATE: NOV. 1979



SYLVAN LAKE

Overall Length of Dam - 272'

Gate Operating
Mechanisms
Conc. Wingwall

715'

Crest of
Embankment

Conc. Training Wall

Conc. Piers

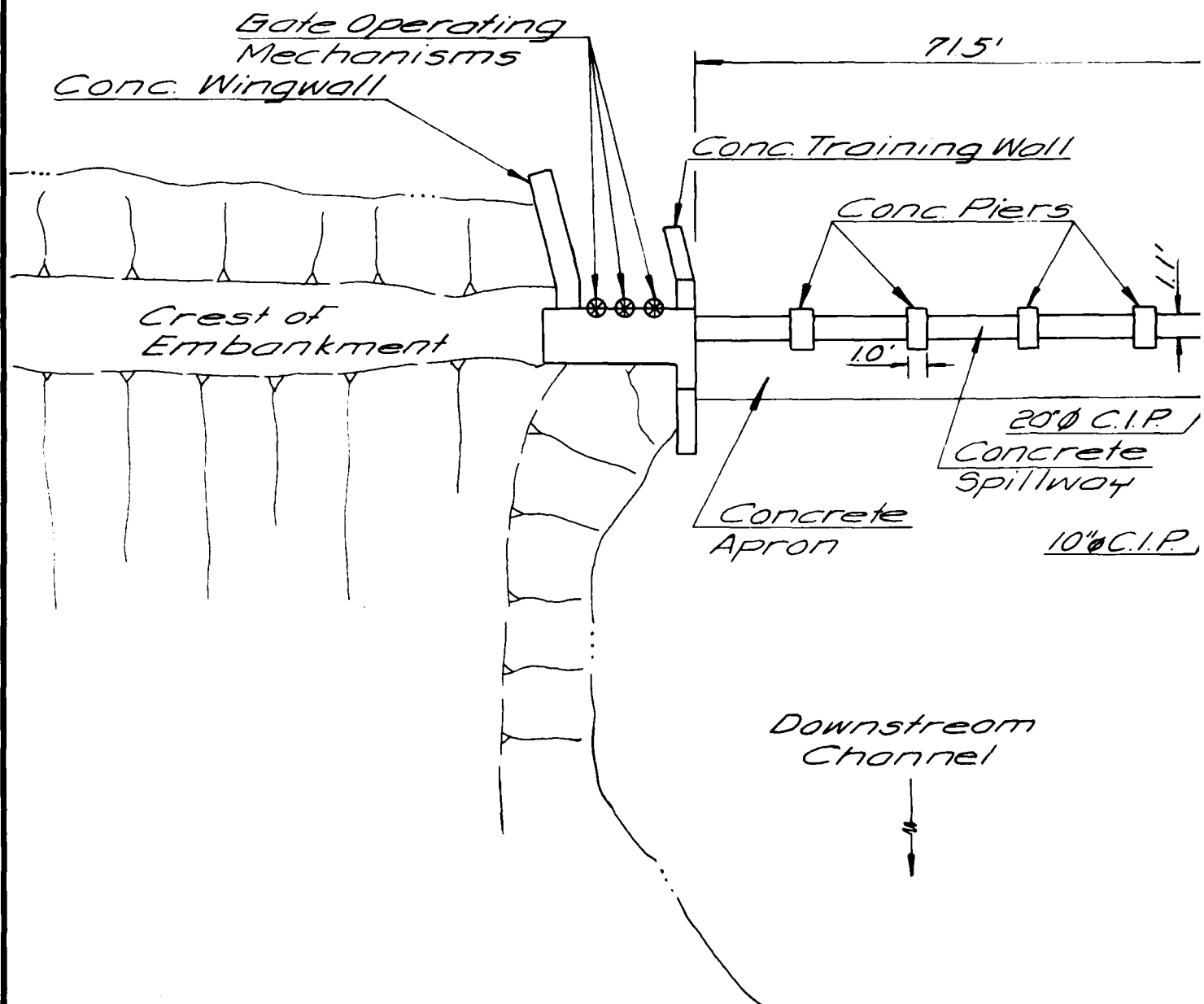
10'

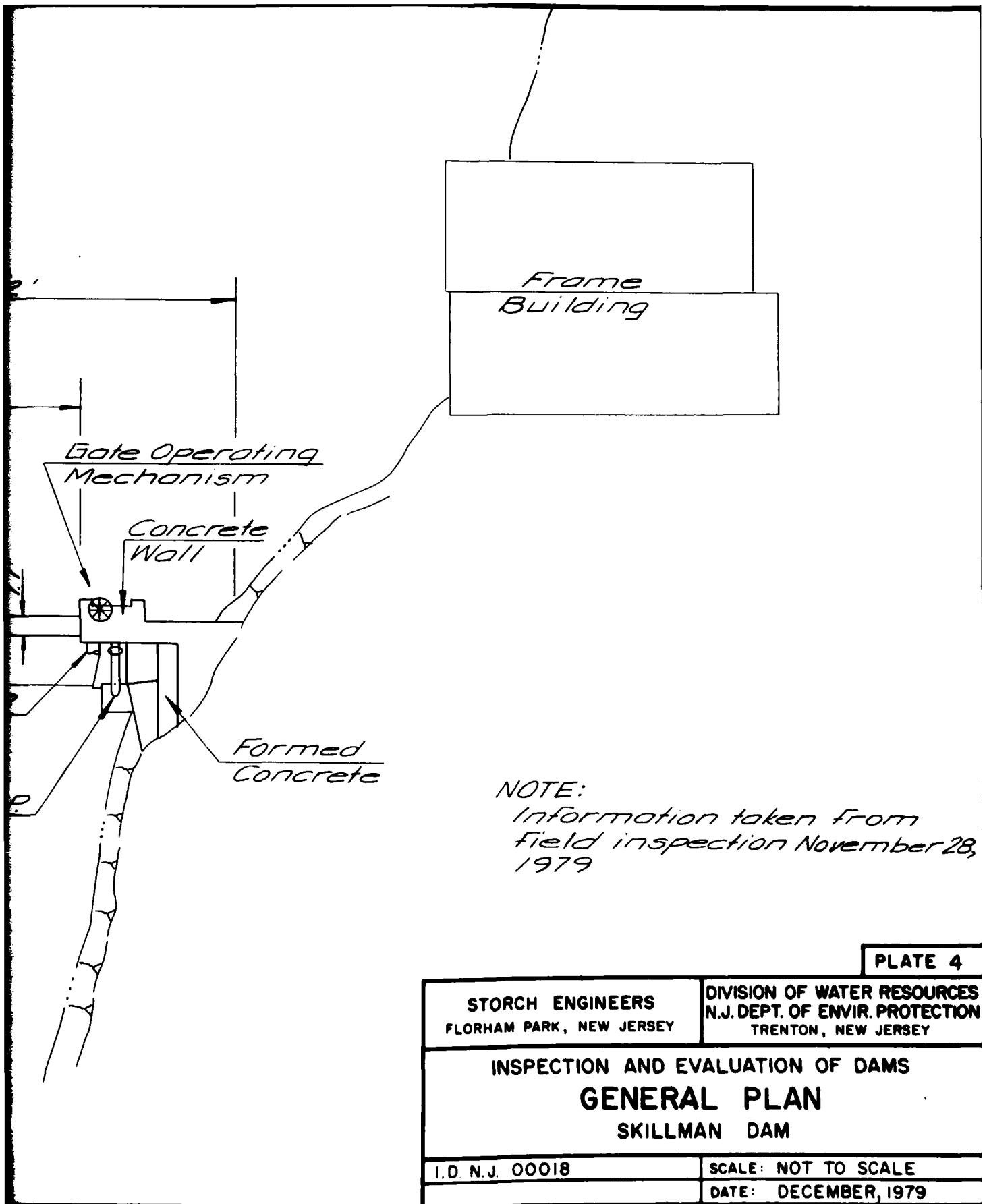
20" ϕ C.I.P.
Concrete
Spillway

Concrete
Apron

10" ϕ C.I.P.

Downstream
Channel

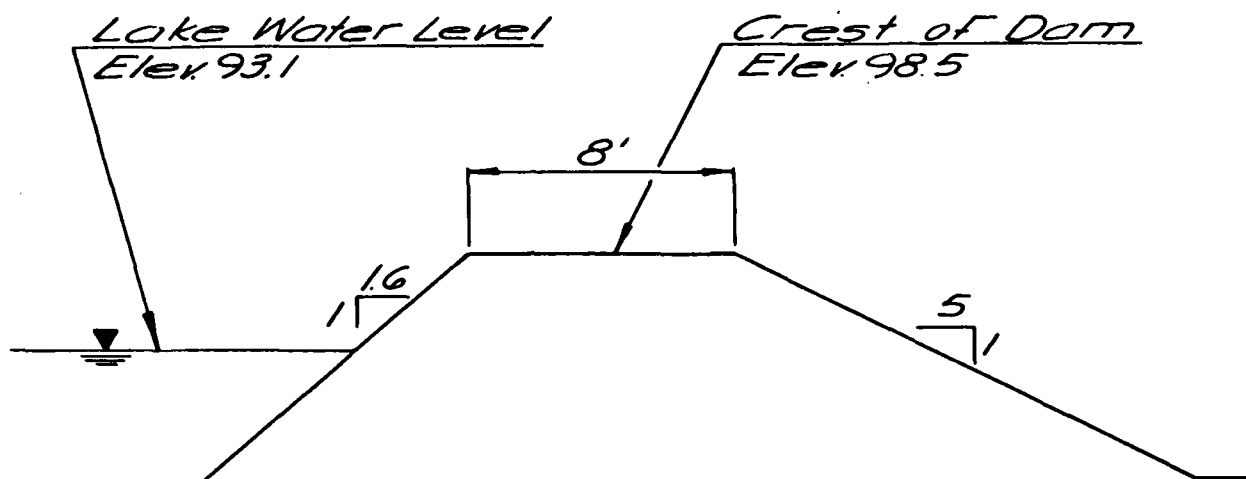




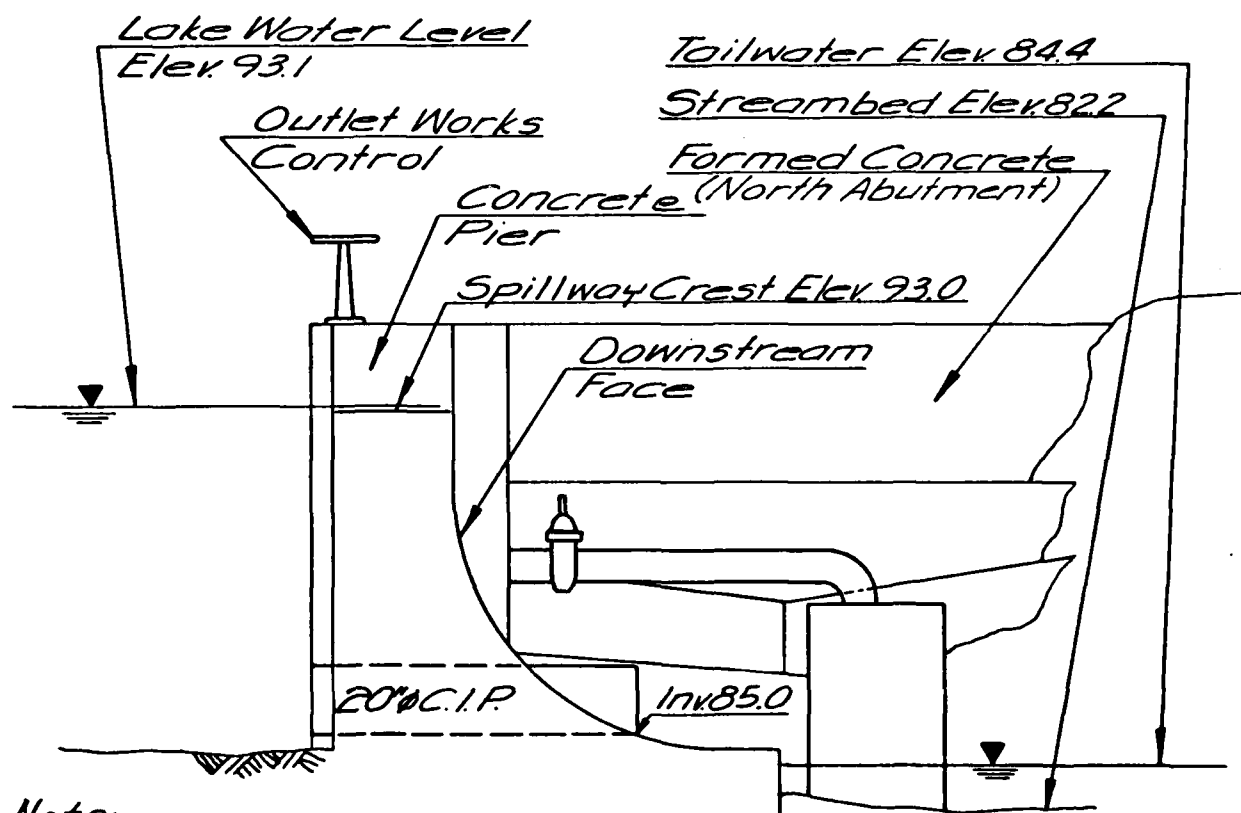
NOTE:
Information taken from
Field inspection November 28,
1979

PLATE 4

STORCH ENGINEERS FLORHAM PARK, NEW JERSEY	DIVISION OF WATER RESOURCES N.J. DEPT. OF ENVIR. PROTECTION TRENTON, NEW JERSEY
INSPECTION AND EVALUATION OF DAMS GENERAL PLAN SKILLMAN DAM	
I.D. N.J. 00018	SCALE: NOT TO SCALE
	DATE: DECEMBER, 1979



DAM SECTION



Note:

*Elevations based on
N.G.V.D. estimated from
U.S.G.S. quadrangle.*

SPILLWAY SECTION

PLATE 5

**STORCH ENGINEERS
FLORHAM PARK, NEW JERSEY**

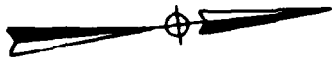
**DIVISION OF WATER RESOURCES
N.J. DEPT. OF ENVIR. PROTECTION
TRENTON, NEW JERSEY**

**INSPECTION AND EVALUATION OF DAMS
SECTIONS
SKILLMAN DAM**

I.D. N.J. 00018

SCALE: NOT TO SCALE

DATE: DECEMBER, 1979



SYLVAN LAKE

Gate Operating Mechanisms
Conc Wingwall

⑨ → Crest of Embankment

⑥ → Conc Training Wall

Conc Piers

② → Concrete Apron

20" CIP
Concrete Spillway

10" CIP

Downstream Channel

OVERVIEW

⑩

①

③

⑧

⑦

⑥

Frame
Building

Gate Operating
Mechanism

Concrete
Wall

③

④

Formed
Concrete

⑤

NOTE:

Information taken from
field inspection November 28,
1979

PLATE 6

STORCH ENGINEERS
FLORHAM PARK, NEW JERSEY

DIVISION OF WATER RESOURCES
N.J. DEPT. OF ENVIR. PROTECTION
TRENTON, NEW JERSEY

INSPECTION AND EVALUATION OF DAMS
PHOTO LOCATION PLAN
SKILLMAN DAM

ID NJ 00018

SCALE NOT TO SCALE

DATE DECEMBER 1979

2

APPENDIX 1

Check List - Visual Inspection

Check List - Engineering Data

Check List
Visual Inspection
Phase I

Name of Dam Skillman Dam County Somerset State New Jersey : Coordinators NJDEP

Date(s) Inspection 11/16/79 Weather Sunny Temperature 60°F
12/11/79

Pool Elevation at Time of Inspection 93.1 M.S.L. Tailwater at Time of Inspection 84.4 M.S.L.

Inspection Personnel:

John Gribbin Alan Volle

Ronald Lai Thomas Miller

Richard McDermott

J. Gribbin Recorder

EMBANKMENT

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
GENERAL	Embankment extremely overgrown with trees, bushes and briars. Briars on crest are bent in the downstream direction - could be due to wind or overtopping. Downstream slope very irregular and poorly defined.	Recommend slope protection for embankment.
JUNCTION OF EMBANKMENT AND ABUTMENT, SPILLWAY AND DAM	Embankment severely eroded on downstream side at abutment with conc. wall at south end of spillway.	Recommend regrading of embankment.
ANY NOTICEABLE SEEPAGE	Standing water observed immediately downstream from toe along right portion of dam. Origin of water could not be determined.	Recommend monitoring of possible seepage.
STAFF GAGE AND RECORDER	None	
DRAINS	None observed.	

EMBANKMENT

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SURFACE CRACKS	None Observed.	
UNUSUAL MOVEMENT OR CRACKING AT OR BEYOND THE TOE	None Observed.	
SLOUGHING OR EROSION OF EMBANKMENT AND ABUTMENT SLOPES	Embankment eroded on upstream and downstream slopes. No sloughing observed.	
VERTICAL AND HORIZONTAL ALIGNMENT OF THE CREST	Vertical: generally level Horizontal: Shape of crest irregular, embankment generally straight.	
RIPRAP FAILURES	No riprap observed:	Recommend slope protection for embankment.

OUTLET WORKS

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONCRETE SURFACES IN OUTLET CONDUIT	N.A.	
INTAKE STRUCTURE	Could not be observed. (submerged)	
OUTLET STRUCTURE	Outlet pipe appeared to be in generally sound condition. Pipe and valve adjacent to outlet and formerly used for water supply appeared to be in generally sound condition.	Three abandoned outlets at south end of spillway could not be observed. Operating mechanisms partially rusted - appeared to be in generally fair to poor condition.
OUTLET CHANNEL	Outlet discharges directly into downstream channel.	
GATE AND GATE HOUSING	Concrete housing appeared to be in satisfactory condition. Gate operating mechanism appeared to be in satisfactory condition. Steel mesh screen appeared to be in generally satisfactory condition.	Lower portion of housing and screen submerged and not observed. Gate was not operated. Recommend inspection with lake drawn down.

SPILLWAY

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONCRETE WEIR	Appeared to be outwardly structurally stable. Evidence of longitudinal cracks was observed on the downstream face. The severity of the cracks could not be determined.	Crest and downstream face obscured by discharge. Upstream face submerged.
TRAINING WALLS	Appeared to be generally stable with some cracks and spalls observed.	
NORTH ABUTMENT	Concrete appeared to be in generally good condition. Concrete wall north of spillway appeared to be generally stable with concrete surface in satisfactory condition.	Concrete formed into rock outcrop at north end of dam appeared to be of more recent construction than remainder of spillway.
DISCHARGE CHANNEL	Spillway discharges directly into downstream channel	
PIERS	Piers appeared to be generally stable with concrete in satisfactory condition.	Former walkway spanning piers in completely removed. Some anchor bolts remain.

INSTRUMENTATION

VISUAL EXAMINATION	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
MONUMENTATION/SURVEYS	None	
OBSERVATION WELLS	None	
WEIRS	None	
PIEZOMETERS	None	
OTHER	N.A.	

RESERVOIR

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SLOPES	North shore grass covered with moderate slope. South shore wooded with generally steep slope.	
SEDIMENTATION	Soundings in the vicinity of the dam indicate the presence of little sedimentation.	
STRUCTURES ALONG BANKS	Two structures are located along the banks of the reservoir: a former ice house and a boat house in which a rowboat equipped with life saving equipment is stored.	

DOWNSTREAM CHANNEL

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONDITION (OBSTRUCTIONS, DEBRIS, ETC.)	Downstream channel is a natural stream with generally well defined banks and a bottom consisting of rocks and soil. The stream contains no significant obstructions.	
SLOPES	Banks are wooded and are generally steep - average slopes approx. 5 horiz. to 1 vert.	
STRUCTURES ALONG BANKS	Buildings associated with maintenance and power supply for the institute located approx. 1600 feet downstream. Exposed steam pipes located along channel. Road bridge located approx. 3200 feet downstream. Sewage treatment plant located approx. 1 mile downstream. Two dwellings located approx. 3200 feet downstream are approx. 12 feet above stream bed.	Garage located approx. 200 feet downstream is approx. 12 feet above stream bed.

CHECK LIST
ENGINEERING DATA
DESIGN, CONSTRUCTION, OPERATION

ITEM	REMARKS
DAM - PLAN	Plans for rehabilitation of north abutment by Storch Engineers, dated Jan. 4, 1972.
SECTIONS	
SPILLWAY - PLAN	Not Available.
SECTIONS	
DETAILS	
OPERATING EQUIPMENT PLANS & DETAILS	Not Available.
OUTLETS - PLAN	Not Available.
DETAILS	
CONSTRAINTS	
DISCHARGE RATINGS	
HYDRAULIC/HYDROLOGIC DATA	Not Available.
RAINFALL/RESERVOIR RECORDS	Not Available.
CONSTRUCTION HISTORY	Not Available.
LOCATION MAP	Available.

ITEM	REMARKS
DESIGN REPORTS	Not Available.
GEOLOGY REPORTS	Not Available.
DESIGN COMPUTATIONS HYDROLOGY & HYDRAULICS DAM STABILITY SEEPAGE STUDIES	Not Available.
MATERIALS INVESTIGATIONS BORING RECORDS LABORATORY FIELD	Not Available.
POST-CONSTRUCTION SURVEYS OF DAM	Not Available.
BORROW SOURCES	Not Available.

ITEM	REMARKS
------	---------

MONITORING SYSTEMS	None
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MODIFICATIONS	Rehabilitation of north abutment - available: Storch Engineers Filling of downstream side of south outlets - available: N.J. Neuropsychiatric Institute
---------------	--

HIGH POOL RECORDS	Not Available.
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POST CONSTRUCTION ENGINEERING STUDIES AND REPORTS	Inspection and report by Storch Engineers, Sept. 15, 1971 Inspection by State of New Jersey, Nov. 3, 1971.
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PRIOR ACCIDENTS OR FAILURE OF DAM DESCRIPTION REPORTS	Descriptions in reports listed above.
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MAINTENANCE OPERATION RECORDS	Not available.
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APPENDIX 2

Photographs



PHOTO 1

28 NOVEMBER 1979

SPIILLWAY



PHOTO 2

11 DECEMBER 1979

DOWNSTREAM FACE OF SPIILLWAY

SKILLMAN DAM



PHOTO 3

OUTLET WORKS OPERATING MECHANISM



PHOTO 4

OUTLET WORKS DISCHARGE PIPE AND ABANDONED WATER SUPPLY PIPE

SKILLMAN DAM
28 NOVEMBER 1979



PHOTO 5

28 NOVEMBER 1979

NORTH ABUTMENT OF DAM



PHOTO 6

11 DECEMBER 1979

ABANDONED GATE CONTROLS ADJACENT TO SOUTH END OF SPILLWAY

SKILLMAN DAM



PHOTO 7

DOWNSTREAM FACE OF DAM ADJACENT TO SOUTH END OF SPILLWAY



PHOTO 8

UPSTREAM FACE OF DAM ADJACENT TO ABANDONED GATE CONTROLS

SKILLMAN DAM
11 DECEMBER 1979



PHOTO 9

CREST AND UPSTREAM FACE OF DAM



PHOTO 10

DOWNSTREAM CHANNEL

SKILLMAN DAM
11 DECEMBER 1979

APPENDIX 3

Engineering Data

CHECK LIST
HYDROLOGIC AND HYDRAULIC DATA
ENGINEERING DATA

DRAINAGE AREA CHARACTERISTICS: Mostly wooded

ELEVATION TOP NORMAL POOL (STORAGE CAPACITY): 93.0 (25 Acre-ft)

ELEVATION TOP FLOOD CONTROL POOL (STORAGE CAPACITY): N.A.

ELEVATION MAXIMUM DESIGN POOL: 102.1

ELEVATION TOP DAM: 98.5

SPILLWAY CREST: Concrete Weir

a. Elevation 93.0

b. Type Straight weir-vertical upstream face

c. Width 1.1 feet

d. Length 67.5 ft. (not including piers)

e. Location Spillover Downstream side of dam

f. Number and Type of Gates None

OUTLET WORKS: 1 Sluice gate

a. Type Sluice gate

b. Location North of spillway

c. Entrance inverts 85.0

d. Exit inverts 85.0

e. Emergency draindown facilities: Open sluice gate

HYDROMETEOROLOGICAL GAGES: None

a. Type N.A.

b. Location N.A.

c. Records N.A.

MAXIMUM NON-DAMAGING DISCHARGE:

(Lake stage equal to top of dam) 2662 c.f.s.

APPENDIX 4

Hydraulic/Hydrologic Computations

HYDROLOGYHydrologic Analysis

Runoff hydrograph will be developed by HEC-1-DB
Computer program using triangular hydrograph
with the curvilinear transformation.

Drainage Area = 7.7 sq. miles

Infiltration Data

Initial infiltration 1.5 in

Constant infiltration 0.15 in/hr

Time of Concentration

By chart on SCS TR-55 flow velocity

Overland flow 2500 ft 2.4%

channel flow 24,000 ft 1.5%

$$TC = \left(\frac{2500}{0.4} + \frac{24000}{1.8} \right) \frac{1}{3600}$$

$$= \underline{\underline{5.4 \text{ hr.}}}$$

Time of Concentration

Nomograph Pg 71 "Design of Small Dam"

$$T = \left(\frac{11.9 L^3}{H} \right)^{0.385}$$

T = T_c in hoursL = length of longest watercourse
in miles

H = elevation difference in feet

$$T_c = \left[\frac{11.9 (5)^3}{420} \right]^{0.385}$$

$$= \underline{\underline{1.6 \text{ hr.}}}$$

Time of concentrationGray's Method Pg 140 "Introduction to
Hydrology"
Viessman et al

$$\text{Area} = 7.7 \text{ Sq mi}$$

$$L = 5 \text{ mi}$$

$$S = 1.6 \%$$

Fig 4-28

$$L/\sqrt{S} = 4.0 \text{ mi}$$

$$PR/\sqrt{S} = 19 \text{ min}$$

Fig 4-29

$$PR = 75 \text{ min}$$

$$\text{Period of rise } PR = \underline{\underline{1.25 \text{ hr.}}}$$

$$\text{Time lag} \approx \underline{\underline{1.25 \text{ hr.}}}$$

Project Skillman DamMade By RL Date 1-2-801132CChkd By JG Date 3/7/80Time of Concentration

By Kerby

"Handbook of Applied Hydrology"
by Chow McGraw Hill Pg 14-36

$$t_c^{2.14} = \frac{2}{3} \frac{L\eta}{\sqrt{S}}$$

t_c = time of concentration
in min.

L = length of overland
flow in ft.

S = slope

η = 0.4 roughness
coef.

$$t_c^{2.14} = \frac{2}{3} \frac{2500 (0.4)}{\sqrt{0.024}}$$

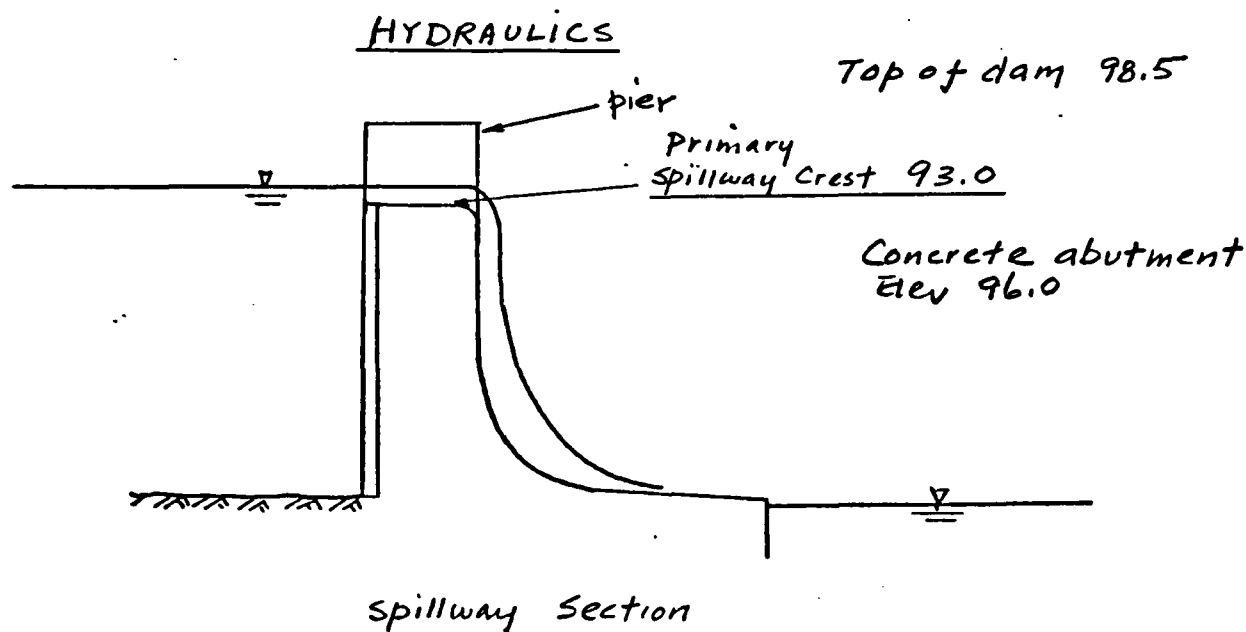
$t_c = 0.83$ hr. for overland flow

$$T_c = 0.83 + \frac{24000}{1.8 \times 3600}$$

$$= \underline{\underline{4.5 \text{ hr.}}}$$

use $T_c = \underline{\underline{4.5 \text{ hr.}}}$

$$\begin{aligned} \text{Lag} &= 0.6 \times 4.5 \\ &= \underline{\underline{2.7 \text{ hr.}}} \end{aligned}$$



$$Q = CLH^{3/2}$$

$$C = 3.0$$

Length of spillway Not including piers = 67.5 ft

Effective length of spillway = 67.5 - 5 = 62.5 ft

5 ft is correction for piers and abutments

use 62.5 feet for length of spillway

Sample calculation

for 1 ft of water
over spillway crest

$$\begin{aligned} Q &= 3 \times 62.5 \times (1)^{3/2} \\ &= \underline{187.5} \text{ cfs} \end{aligned}$$

STORCH ENGINEERS

Sheet 5 of 10Project Skillman DamMade By RL Date 1-2-19801132 CChkd By JG Date 3/7/80

Spillway

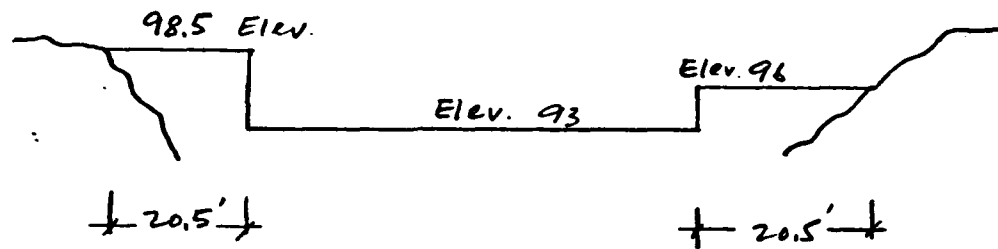
Stage Discharge Tabulation

W. L. (ft.)	Head H (ft.)	$H^{3/2}$	C	Q (cfs)
93.0	0	0	3	0
94.0	1	1	3	188.0
95.0	2	2.8	3	525.0
96.0	3	5.2	3	975.0
97.0	4	8	3	1500.0
98.0	5	11.2	3	2100.0
98.5 Top of dam	5.5	12.9	3	2419.0
100.0	7	18.5	3	3469.0
101.0	8	22.6	3	4238.0
102.0	9	27.0	3	5063.0

Project Skullman Dam Made By RL Date 1-3-80
1132 C Chkd By JG Date 3/7/80

For overflow over concrete walls

$$L = 20.5' \text{ ea.} \quad Q = CLH^{3/2} \quad C = 3.0$$



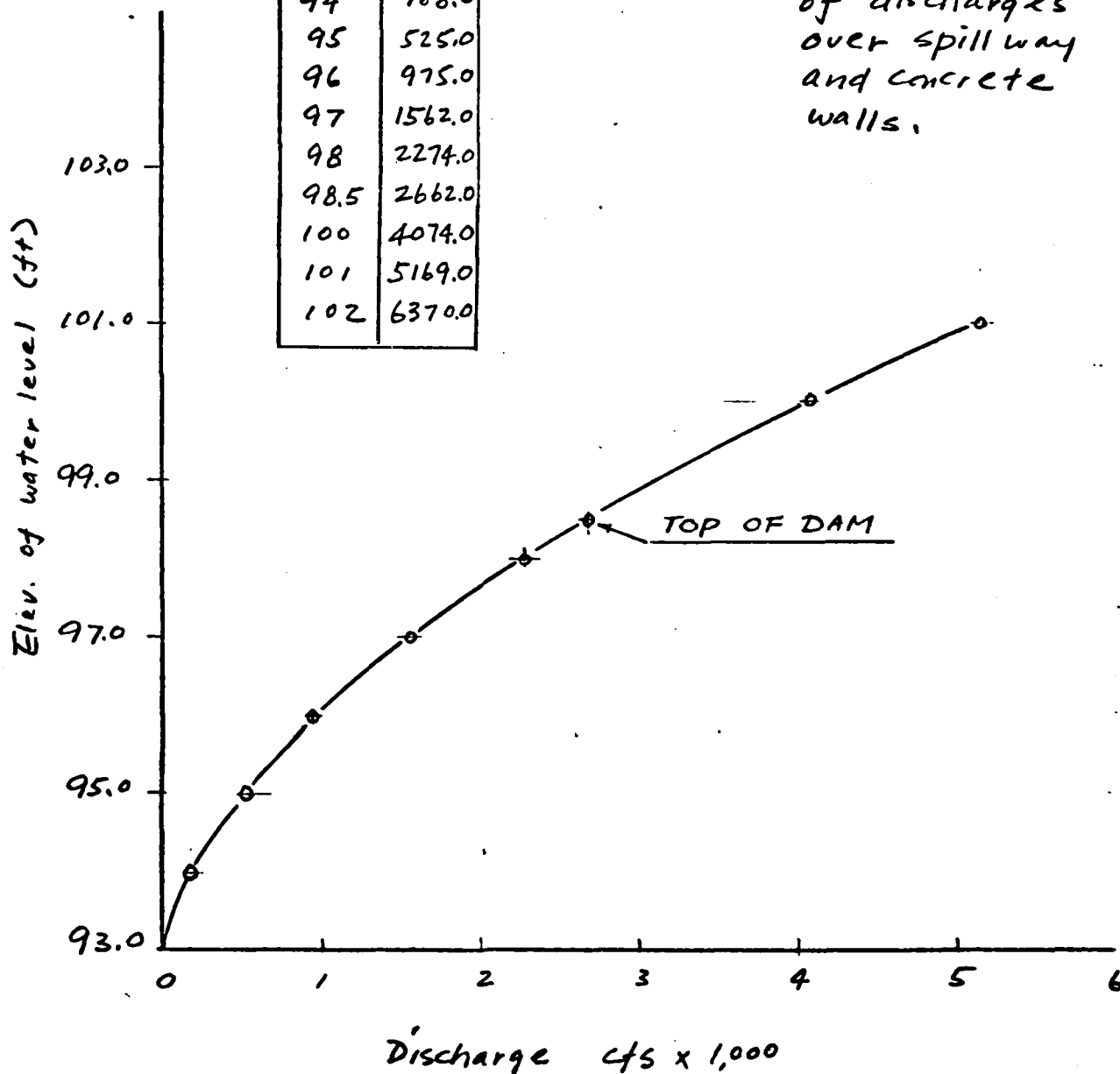
Stage Discharge Table

Elev (ft)	Q (cfs)
96	0
97	62
98	174
98.5	243
100	605
101	931
102	1307

Project Skillman Dam
1132CMade By RL Date 1-3-80Chkd By JG Date 3/7/80STAGE DISCHARGE CURVE

WL (ft)	Q (cfs)
93	0
94	188.0
95	525.0
96	975.0
97	1562.0
98	2274.0
98.5	2662.0
100	4074.0
101	5169.0
102	6370.0

Note: Q includes sum
of discharges
over spillway
and concrete
walls.



STORCH ENGINEERS

Sheet 8 of 10

Project Skillman Dam
1132C

Made By RL Date 1-2-80

Chkd By JG Date 3/7/80

Lake Storage Volume

Elev. (MSL)	Surface Area (Ac)
85	0
93	9.2
100	41.3
120	252.5

HEL-1-DB program will develop storage
capacity from surface area and elevation

Project Skillman DamMade By RL Date 1-2-801132 CChkd By JG Date 3/7/80Outlet Works Capacity

20" CIP outlet control

At normal pool $H = 6.6 \text{ ft}$ $Q = 26 \text{ cfs}$ (Hydraulic Charts for Hwy Culverts)

Storage at normal pool = 25 AC-ft

Estimated drawdown time

Assume inflow = 8 cfs (1 cfs/s.m.)

$$\text{Time} = \frac{25 \times 43560}{(13 - 8)} \times \frac{1}{3600} = 60.5 \text{ hr.}$$
$$= 2.5 \text{ days}$$

STORCH ENGINEERS

Sheet 10 of 10

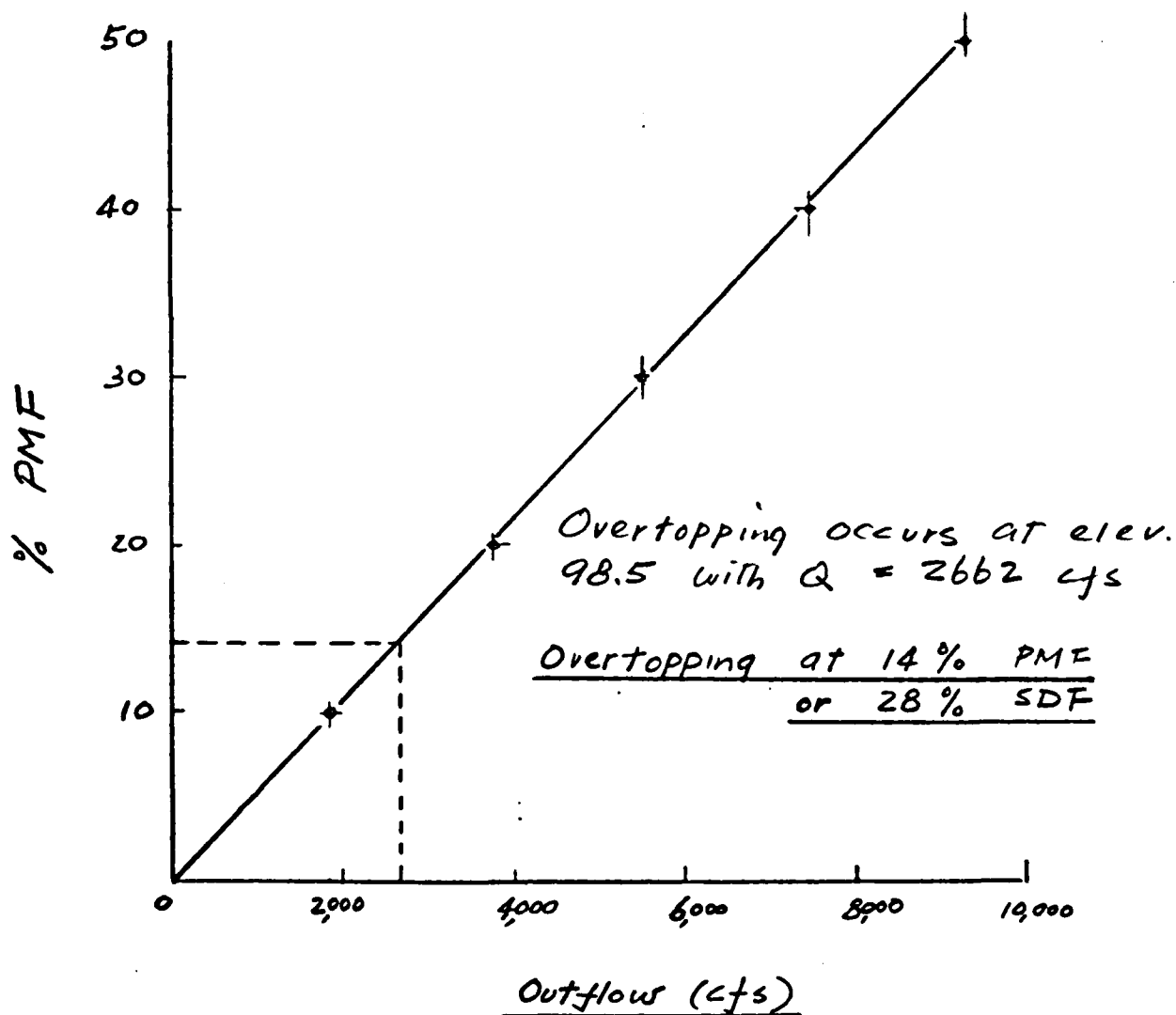
Project Skillman Dam

Made By RL Date 1-7-80

1132 C

Chkd By JG Date 3/7/80

Overtopping Potential



HEC-1-DB COMPUTATIONS

 FLOOD HYDROGRAPH PACKAGE (HEC-1)
 DAM SAFETY VERSION JULY 1978
 LAST MODIFICATION 26 FEB 79

RUN DATE# 80/01/04
 TIME# 08-08-31

NATIONAL DAM SAFETY PROGRAM
 SKILLMAN DAM NEW JERSEY
 MULTI RATIO ROUTING

NQ	NHR	NMIN	IDAY	IHR	IMIN	MEYR	IPLI	IPRI	NSTAN
250	0	10	0	0	0	0	0	3	0
		JOPER	LROPI	TRACE					
		5	0	0					

MULTI-PLAN ANALYSES TO BE PERFORMED
 NPLAN= 1 NRTIO= 5 LRTIO= 1

RTIOS= .50

***** SUB-AREA RUNOFF COMPUTATION *****

INFLOW HYDROGRAPH TO SKILLMAN LAKE

ISTAQ	ICOMP	IECON	ITAPE	JPLI	JPRT	INAME	ISTAGE	IAUTO
0	0	0	0	0	0	1	0	0

HYDROGRAPH DATA
 TRSDA TRSPE RATIO ISNOW ISAME LOCAL
 7.70 0.00 0.000 0 1 0

PRECIP DATA
 R12 R22 R32 R42 R52 R62 R72 R82 R92
 100.00 100.00 100.00 100.00 100.00 100.00 100.00 100.00 100.00

LOSS DATA
 STIRL STIRK RTIOK STIRL CNSTL ALSMX RTIMP
 0.00 0.00 1.00 0.00 0.00 0.00 0.00 0.00 0.00

UNIT HYDROGRAPH DATA
 TC= 0.00 LAG= 2.70

RECESSION DATA
 STRIO= -1.00 GRCSME = .05 RTIOE= 2.00

UNIT HYDROGRAPH	END OF PERIOD	ORDINATES	TC	0.00	HOURS	LAG	2.70	VOL	1.00
24.	59.	115.	181.	251.	455.	583.	726.	878.	
1007.	1122.	1210.	1271.	1321.	1333.	1325.	1292.	1244.	
1186.	1130.	1066.	932.	812.	726.	646.	580.	524.	
176.	130.	106.	93.	81.	72.	64.	58.	52.	
182.	166.	150.	124.	112.	101.	92.	83.	74.	
26.	24.	21.	17.	14.	11.	8.	5.	4.	
11.	10.	9.	8.	7.	6.	5.	4.	3.	
12.	11.	10.	9.	8.	7.	6.	5.	4.	

TRSPC COMPUTED BY THE PROGRAM IS .800

MO.	DA	D	HR.	MM	PERIOD	RAIN	EXCS	LOSS	COMP	G
1	01	1	01	10	1	02	00	02	7	0
1	01	1	01	20	2	00	00	02	7	0
1	01	1	01	30	3	00	00	02	7	0
1	01	1	01	40	4	00	00	02	7	0
1	01	1	01	50	5	00	00	02	7	0
1	01	1	01	00	6	00	00	02	7	0
1	01	1	01	10	7	00	00	02	7	0
1	01	1	01	20	8	00	00	02	7	0
1	01	1	01	30	9	00	00	02	7	0
1	01	1	01	40	10	00	00	02	7	0
1	01	1	01	50	11	00	00	02	7	0
1	01	1	01	00	12	00	00	02	7	0
1	01	1	01	10	13	00	00	02	7	0
1	01	1	01	20	14	00	00	02	7	0
1	01	1	01	30	15	00	00	02	7	0
1	01	1	01	40	16	00	00	02	7	0
1	01	1	01	50	17	00	00	02	7	0
1	01	1	01	00	18	00	00	02	7	0
1	01	1	01	10	19	00	00	02	7	0
1	01	1	01	20	20	00	00	02	7	0
1	01	1	01	30	21	00	00	02	7	0
1	01	1	01	40	22	00	00	02	7	0
1	01	1	01	50	23	00	00	02	7	0
1	01	1	01	00	24	00	00	02	7	0
1	01	1	01	10	25	00	00	02	7	0
1	01	1	01	20	26	00	00	02	7	0
1	01	1	01	30	27	00	00	02	7	0
1	01	1	01	40	28	00	00	02	7	0
1	01	1	01	50	29	00	00	02	7	0
1	01	1	01	00	30	00	00	02	7	0
1	01	1	01	10	31	00	00	02	7	0
1	01	1	01	20	32	00	00	02	7	0
1	01	1	01	30	33	00	00	02	7	0
1	01	1	01	40	34	00	00	02	7	0
1	01	1	01	50	35	00	00	02	7	0
1	01	1	01	00	36	00	00	02	7	0
1	01	1	01	10	37	00	00	02	7	0
1	01	1	01	20	38	00	00	02	7	0
1	01	1	01	30	39	00	00	02	7	0
1	01	1	01	40	40	00	00	02	7	0
1	01	1	01	50	41	00	00	02	7	0
1	01	1	01	00	42	00	00	02	7	0
1	01	1	01	10	43	00	00	02	7	0
1	01	1	01	20	44	00	00	02	7	0
1	01	1	01	30	45	00	00	02	7	0
1	01	1	01	40	46	00	00	02	7	0
1	01	1	01	50	47	00	00	02	7	0
1	01	1	01	00	48	00	00	02	7	0
1	01	1	01	10	49	00	00	02	7	0
1	01	1	01	20	50	00	00	02	7	0
1	01	1	01	30	51	00	00	02	7	0
1	01	1	01	40	52	00	00	02	7	0
1	01	1	01	50	53	00	00	02	7	0
1	01	1	01	00	54	00	00	02	7	0
1	01	1	01	10	55	00	00	02	7	0
1	01	1	01	20	56	00	00	02	7	0
1	01	1	01	30	57	00	00	02	7	0
1	01	1	01	40	58	00	00	02	7	0
1	01	1	01	50	59	00	00	02	7	0
1	01	1	01	00	60	00	00	02	7	0
1	01	1	01	10	61	00	00	02	7	0
1	01	1	01	20	62	00	00	02	7	0

MO.DA	HR.MN	PERIOD	RAIN	EXCS	LOSS	COFF Q
1.01	10.30	63	.05	.03	.03	124.
1.01	10.40	64	.05	.03	.03	154.
1.01	10.50	65	.05	.03	.03	187.
1.01	11.00	66	.05	.03	.03	221.
1.01	11.10	67	.05	.03	.03	256.
1.01	11.20	68	.05	.03	.03	292.
1.01	11.30	69	.05	.03	.03	328.
1.01	11.40	70	.05	.03	.03	364.
1.01	11.50	71	.05	.03	.03	399.
1.01	12.00	72	.05	.03	.03	433.
1.01	12.10	73	.05	.03	.03	472.
1.01	12.20	74	.05	.03	.03	512.
1.01	12.30	75	.05	.03	.03	552.
1.01	12.40	76	.05	.03	.03	592.
1.01	12.50	77	.05	.03	.03	633.
1.01	13.00	78	.05	.03	.03	674.
1.01	13.10	79	.05	.03	.03	715.
1.01	13.20	80	.05	.03	.03	756.
1.01	13.30	81	.05	.03	.03	797.
1.01	13.40	82	.05	.03	.03	838.
1.01	13.50	83	.05	.03	.03	879.
1.01	14.00	84	.05	.03	.03	920.
1.01	14.10	85	.05	.03	.03	961.
1.01	14.20	86	.05	.03	.03	1002.
1.01	14.30	87	.05	.03	.03	1043.
1.01	14.40	88	.05	.03	.03	1084.
1.01	14.50	89	.05	.03	.03	1125.
1.01	15.00	90	.05	.03	.03	1166.
1.01	15.10	91	.05	.03	.03	1207.
1.01	15.20	92	.05	.03	.03	1248.
1.01	15.30	93	.05	.03	.03	1289.
1.01	15.40	94	.05	.03	.03	1330.
1.01	15.50	95	.05	.03	.03	1371.
1.01	16.00	96	.05	.03	.03	1412.
1.01	16.10	97	.05	.03	.03	1453.
1.01	16.20	98	.05	.03	.03	1494.
1.01	16.30	99	.05	.03	.03	1535.
1.01	16.40	100	.05	.03	.03	1576.
1.01	16.50	101	.05	.03	.03	1617.
1.01	17.00	102	.05	.03	.03	1658.
1.01	17.10	103	.05	.03	.03	1699.
1.01	17.20	104	.05	.03	.03	1740.
1.01	17.30	105	.05	.03	.03	1781.
1.01	17.40	106	.05	.03	.03	1822.
1.01	17.50	107	.05	.03	.03	1863.
1.01	18.00	108	.05	.03	.03	1904.
1.01	18.10	109	.05	.03	.03	1945.
1.01	18.20	110	.05	.03	.03	1986.
1.01	18.30	111	.05	.03	.03	2027.
1.01	18.40	112	.05	.03	.03	2068.
1.01	18.50	113	.05	.03	.03	2109.
1.01	19.00	114	.05	.03	.03	2150.
1.01	19.10	115	.05	.03	.03	2191.
1.01	19.20	116	.05	.03	.03	2232.
1.01	19.30	117	.05	.03	.03	2273.
1.01	19.40	118	.05	.03	.03	2314.
1.01	19.50	119	.05	.03	.03	2355.
1.01	20.00	120	.05	.03	.03	2396.
1.01	20.10	121	.05	.03	.03	2437.
1.01	20.20	122	.05	.03	.03	2478.
1.01	20.30	123	.05	.03	.03	2519.
1.01	20.40	124	.05	.03	.03	2560.
1.01	20.50	125	.05	.03	.03	2601.

MO.DA	HR.MN	PERIOD	RAIN	EXCS	LOSS	COMP Q
1.001	21.00	126	.03	.00	.00	8469.
1.001	21.10	127	.03	.00	.00	1776.
1.001	21.20	128	.03	.00	.00	1125.
1.001	21.30	129	.03	.00	.00	1125.
1.001	21.40	130	.03	.00	.00	6507.
1.001	21.50	131	.03	.00	.00	5525.
1.001	22.00	132	.03	.00	.00	5525.
1.001	22.10	133	.03	.00	.00	4817.
1.001	22.20	134	.03	.00	.00	4817.
1.001	22.30	135	.03	.00	.00	4817.
1.001	22.40	136	.03	.00	.00	4817.
1.001	22.50	137	.03	.00	.00	4817.
1.001	23.00	138	.03	.00	.00	4817.
1.001	23.10	139	.03	.00	.00	4817.
1.001	23.20	140	.03	.00	.00	4817.
1.001	23.30	141	.03	.00	.00	4817.
1.001	23.40	142	.03	.00	.00	4817.
1.001	23.50	143	.03	.00	.00	4817.
1.001	00.00	144	.03	.00	.00	4817.
1.001	00.10	145	.03	.00	.00	4817.
1.001	00.20	146	.03	.00	.00	4817.
1.001	00.30	147	.03	.00	.00	4817.
1.001	00.40	148	.03	.00	.00	4817.
1.001	00.50	149	.03	.00	.00	4817.
1.001	01.00	150	.03	.00	.00	4817.
1.001	01.10	151	.03	.00	.00	4817.
1.001	01.20	152	.03	.00	.00	4817.
1.001	01.30	153	.03	.00	.00	4817.
1.001	01.40	154	.03	.00	.00	4817.
1.001	01.50	155	.03	.00	.00	4817.
1.001	02.00	156	.03	.00	.00	4817.
1.001	02.10	157	.03	.00	.00	4817.
1.001	02.20	158	.03	.00	.00	4817.
1.001	02.30	159	.03	.00	.00	4817.
1.001	02.40	160	.03	.00	.00	4817.
1.001	02.50	161	.03	.00	.00	4817.
1.001	03.00	162	.03	.00	.00	4817.
1.001	03.10	163	.03	.00	.00	4817.
1.001	03.20	164	.03	.00	.00	4817.
1.001	03.30	165	.03	.00	.00	4817.
1.001	03.40	166	.03	.00	.00	4817.
1.001	03.50	167	.03	.00	.00	4817.
1.001	04.00	168	.03	.00	.00	4817.
1.001	04.10	169	.03	.00	.00	4817.
1.001	04.20	170	.03	.00	.00	4817.
1.001	04.30	171	.03	.00	.00	4817.
1.001	04.40	172	.03	.00	.00	4817.
1.001	04.50	173	.03	.00	.00	4817.
1.001	05.00	174	.03	.00	.00	4817.
1.001	05.10	175	.03	.00	.00	4817.
1.001	05.20	176	.03	.00	.00	4817.
1.001	05.30	177	.03	.00	.00	4817.
1.001	05.40	178	.03	.00	.00	4817.
1.001	05.50	179	.03	.00	.00	4817.
1.001	06.00	180	.03	.00	.00	4817.
1.001	06.10	181	.03	.00	.00	4817.
1.001	06.20	182	.03	.00	.00	4817.
1.001	06.30	183	.03	.00	.00	4817.
1.001	06.40	184	.03	.00	.00	4817.
1.001	06.50	185	.03	.00	.00	4817.
1.001	07.00	186	.03	.00	.00	4817.
1.001	07.10	187	.03	.00	.00	4817.

MO. DA	HP. MN	PERIOD	RAIN	EXCS	LOSS	COMP Q
1.02	7.20	188	0.00	0.20	0.20	66.
1.02	7.30	189	0.00	0.00	0.00	61.
1.02	7.40	190	0.00	0.00	0.00	57.
1.02	7.50	191	0.00	0.00	0.00	53.
1.02	8.00	192	0.00	0.00	0.00	50.
1.02	8.10	193	0.00	0.00	0.00	46.
1.02	8.20	194	0.00	0.00	0.00	43.
1.02	8.30	195	0.00	0.00	0.00	40.
1.02	8.40	196	0.00	0.00	0.00	38.
1.02	8.50	197	0.00	0.00	0.00	35.
1.02	9.00	198	0.00	0.00	0.00	33.
1.02	9.10	199	0.00	0.00	0.00	31.
1.02	9.20	200	0.00	0.00	0.00	29.
1.02	9.30	201	0.00	0.00	0.00	27.
1.02	9.40	202	0.00	0.00	0.00	25.
1.02	9.50	203	0.00	0.00	0.00	23.
1.02	10.00	204	0.00	0.00	0.00	22.
1.02	10.10	205	0.00	0.00	0.00	20.
1.02	10.20	206	0.00	0.00	0.00	19.
1.02	10.30	207	0.00	0.00	0.00	18.
1.02	10.40	208	0.00	0.00	0.00	16.
1.02	10.50	209	0.00	0.00	0.00	15.
1.02	11.00	210	0.00	0.00	0.00	14.
1.02	11.10	211	0.00	0.00	0.00	13.
1.02	11.20	212	0.00	0.00	0.00	12.
1.02	11.30	213	0.00	0.00	0.00	12.
1.02	11.40	214	0.00	0.00	0.00	11.
1.02	11.50	215	0.00	0.00	0.00	10.
1.02	12.00	216	0.00	0.00	0.00	9.
1.02	12.10	217	0.00	0.00	0.00	9.
1.02	12.20	218	0.00	0.00	0.00	8.
1.02	12.30	219	0.00	0.00	0.00	8.
1.02	12.40	220	0.00	0.00	0.00	7.
1.02	12.50	221	0.00	0.00	0.00	7.
1.02	13.00	222	0.00	0.00	0.00	6.
1.02	13.10	223	0.00	0.00	0.00	6.
1.02	13.20	224	0.00	0.00	0.00	5.
1.02	13.30	225	0.00	0.00	0.00	5.
1.02	13.40	226	0.00	0.00	0.00	5.
1.02	13.50	227	0.00	0.00	0.00	4.
1.02	14.00	228	0.00	0.00	0.00	4.
1.02	14.10	229	0.00	0.00	0.00	4.
1.02	14.20	230	0.00	0.00	0.00	4.
1.02	14.30	231	0.00	0.00	0.00	3.
1.02	14.40	232	0.00	0.00	0.00	3.
1.02	14.50	233	0.00	0.00	0.00	3.
1.02	15.00	234	0.00	0.00	0.00	3.
1.02	15.10	235	0.00	0.00	0.00	3.
1.02	15.20	236	0.00	0.00	0.00	2.
1.02	15.30	237	0.00	0.00	0.00	2.
1.02	15.40	238	0.00	0.00	0.00	2.
1.02	15.50	239	0.00	0.00	0.00	2.
1.02	16.00	240	0.00	0.00	0.00	2.
1.02	16.10	241	0.00	0.00	0.00	2.
1.02	16.20	242	0.00	0.00	0.00	2.
1.02	16.30	243	0.00	0.00	0.00	1.
1.02	16.40	244	0.00	0.00	0.00	1.
1.02	16.50	245	0.00	0.00	0.00	1.
1.02	17.00	246	0.00	0.00	0.00	1.
1.02	17.10	247	0.00	0.00	0.00	1.
1.02	17.20	248	0.00	0.00	0.00	1.
1.02	17.30	249	0.00	0.00	0.00	1.
1.02	17.40	250	0.00	0.00	0.00	1.

SUM 24.34 20.54 3.80 616261.
(618.)(522.)(96.)(17450.57)

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	18803.	13543.	4276.	2465.	616258.
CMS	532.	384.	121.	70.	17450.
INCHES		16.36	20.66	20.68	20.68
MM		415.58	524.86	525.28	525.28
AC-FT		6716.	8482.	8488.	8488.
THOUS CU M		8284.	10462.	10470.	10470.

HYDROGRAPH AT STA LAKE FOR PLAN 1, RTIO 1

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	9401.	6772.	2138.	1233.	308129.
CMS	266.	192.	61.	35.	8725.
INCHES		8.18	10.33	10.34	10.34
MM		207.79	262.43	262.64	262.64
AC-FT		3358.	4241.	4244.	4244.
THOUS CU M		4142.	5231.	5235.	5235.

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 99999999910010999999999999

PEAK OUTFLOW IS 9309. AT TIME 18.67 HOURS

THOUS	CU-T	INCHES	CMSS	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL
1	1	1	1	9309.	6738.	2132.	1232.	308140.
2	2	2	2	264.	191.	61.	35.	8726.
3	3	3	3		8.	32	10.	1034.
4	4	4	4		176	1032	20245	26265
5	5	5	5		208	16242	10245	26244.
6	6	6	6		341.	4231.	5235.	5235.
7	7	7	7		412.	5231.	5235.	5235.

THOUS CU M
AC-FT M
INCHES
CMS

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•
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RATIO OF PMF	FLEVATION STORAGE OUTFLOW	INITIAL VALUE	SPILLWAY CREST	TOP	OF DAM	TIME OF FAILURE HOURS
0.50	162.68	93.50	93.00	98.50	0.00	
0.40	161.28	25.00	25.00	133.00	0.00	
0.30	160.00	25.00	25.00	133.00	0.00	
0.20	99.30	25.00	25.00	2662.00	0.00	
0.10	97.36	25.00	25.00	2662.00	0.00	

RATIO OF PMF	MAXIMUM RESERVOIR W.S.FLEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
0.50	162.68	3.58	287.00	9329.00	6.83	18.67	0.00
0.40	161.28	2.78	245.00	7451.00	5.83	18.67	0.00
0.30	160.00	1.89	204.00	5296.00	4.83	18.67	0.00
0.20	99.30	0.89	163.00	3715.00	3.17	18.67	0.00
0.10	97.36	0.00	100.00	1833.00	0.00	18.83	0.00

SUMMARY OF DAM SAFETY ANALYSIS

PLAN 1	STATION 1	MAXIMUM FLOW,CFS	MAXIMUM STAGE,FT	TIME HOURS
RATIO				
.50		9306.	85.6	18.67
.40		7450.	84.6	18.67
.30		5584.	83.4	18.67
.20		3710.	81.9	18.67
.10		1832.	80.0	18.83

PLAN 2	STATION 2	MAXIMUM FLOW,CFS	MAXIMUM STAGE,FT	TIME HOURS
RATIO				
.50		9300.	78.4	18.67
.40		7444.	77.1	18.67
.30		5579.	75.6	18.67
.20		3709.	73.7	18.83
.10		1830.	71.0	19.00

SUMMARY OF DAM SAFETY ANALYSIS

RATIO OF PMF	ELEVATION STORAGE OUTFLOW	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
.50	98.59	93.00 25. 0.	93.00 25. 0.	98.50 133. 2662.	.29	18.50	15.50

APPENDIX 5

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